

Gemini Observing Opportunities for Semester 2004B

Taft Armandroff

The NOAO Gemini Science Center (NGSC) invites and encourages the US community to submit proposals for Gemini observing opportunities during semester 2004B. 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 2004B will not be released until March 1 for the US proposal deadline of March 31, the following are our expectations of what will be offered in semester 2004B. 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.

NGSC is pleased to report that exciting new instrumental capabilities are expected to be offered in semester 2004B, as described below.

Gemini North

- The GMOS-North optical multi-object spectrograph and imager will be offered in 2004B. 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 2004B. 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 with a size of three nights or longer (see the 2004B Call for Proposals).
- The Altair adaptive optics (AO) system will be offered for scientific observations in 2004B. The following modes of Altair are expected to be offered in 2004B: AO-enhanced infrared imaging and spectroscopy using NIRI.
- Michelle is a mid-infrared (8–25 micron) imager and spectrograph. Michelle is expected to be offered for imaging for all of semester 2004B and for spectroscopy (resolutions of R=200 and R=3000) late in the semester. Michelle would be offered only in Queue mode. Note that after three months at UKIRT (United Kingdom Infra-Red Telescope) during semester 2004A, Michelle will return to Gemini for the longer term. Gemini plans to reintegrate and recommission Michelle during June and July. Michelle spectroscopy requires additional commissioning and system verification, which explains the likelihood of offering spectroscopy for only the second half of the semester.

Gemini South

- The GMOS-South optical multi-object spectrograph and imager will be offered during semester 2004B. The imaging, long-slit spectroscopy, multi-object spectroscopy, and nod-and-shuffle modes of GMOS-South are expected to be offered in 2004B. The GMOS-South IFU is undergoing System Verification during semester 2004A, and thus it is likely to be available to proposers during semester 2004B.
- The T-ReCS mid-infrared imager and spectrometer will be available in semester 2004B. Both the imaging and spectroscopic modes of T-ReCS are expected to be offered in 2004B.
- GMOS-South and T-ReCS will be offered in both Queue and Classical modes. It is expected that Classical will only be offered to programs with a size of three nights or longer (see the 2004B Call for Proposals).
- The Phoenix infrared high-resolution spectrograph will be offered in semester 2004B.
- The Acquisition Camera will be available for time-series photometry in 2004B.
- The GNIRS facility infrared spectrograph will probably be offered in semester 2004B. This is not yet certain because, as of late January, GNIRS is in the on-telescope commissioning process (see subsequent article "GNIRS Commissioning"). GNIRS has several observing modes. It is likely that only GNIRS's basic modes (long-slit spectroscopy with resolutions R=2000 and R=6000; cross-dispersed spectroscopy at R=2000 with continuous coverage from 1 to 2.5 microns) will be available in 2004B. Please check the 2004B Gemini Call for Proposals for additional GNIRS information. GNIRS would be offered only in Queue mode.

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 2004B, at both Gemini North and Gemini South.

We remind the community that US Gemini proposals can be submitted jointly with collaborators in another Gemini partner. An observing team submits proposals in each relevant partner country, explicitly noting how much time is requested from

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Gemini Observing Opportunities continued

each Gemini partner. Such multipartner proposals are encouraged because they access a larger fraction of the available Gemini time, thus enabling 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).

Queue programs assigned by the International TAC (ITAC) into queue Science Ranking Band 1 (the highest priority band) will be eligible for rollover into the next semester.

A program without a complete set of ITAC-approved observations will be rolled over for no more than two consecutive semesters, in order to increase the likelihood of program completion. Eligibility for rollover will be decided at the 2004B ITAC meeting, and proposers will be notified of rollover status in their ITAC feedback. Rollover will apply to Band-1 queue programs only.

It is likely that a special opportunity for Gemini follow-up of Spitzer Space Telescope programs will be announced in the 2004B Call for Proposals.

GNIRS Key Science Opportunity

Taft Armandroff, Steve Strom & Jeremy Mould

As discussed elsewhere in this newsletter, the Gemini Near-Infrared Spectrograph (GNIRS) is undergoing commissioning and is nearing availability for observing to the Gemini communities. NOAO is keen to see the powerful capabilities of GNIRS exploited for major scientific initiatives. These could include:

- Spectroscopic follow-up for the Spitzer Space Telescope
- Moderate-resolution near-infrared spectroscopy of individual stars and substellar objects
- Studies of the dynamics and excitation of pre-main-sequence star disks and jets
- Dynamical and abundance investigations of stellar populations in galaxies, such as the inner bulge of our galaxy, and the late-type giants in M32
- Investigation of the dynamics, excitation, and abundances of gas in nearby active galactic nuclei
- Dynamical, excitation, and abundance studies of starburst galaxies and ultraluminous IRAS galaxies
- Study of stellar and gaseous dynamics and excitation in radio galaxy hosts, and the origin of radio jet/host galaxy alignment

As announced in the December 2003 *NOAO/NSO Newsletter*, NOAO is conducting a pilot program to enable observations with high scientific potential that require significant blocks of time with GNIRS on Gemini South (15 to 20 nights over the next two to three years). Proposers must agree to make all Gemini data and ancillary information available publicly following a minimal proprietary period (less than six months). Please submit such proposals using the normal NOAO Time Allocation Committee (TAC) process, but indicate in the Abstract that your proposal is to be considered for the "GNIRS Key Science Opportunity." The TAC will evaluate the scientific merit of these proposals. In addition, because discretionary time from the NOAO Director will be used for this program, the Director will employ the following criteria in evaluating proposals:

- Intrinsic scientific merit as evaluated by the TAC
- Breadth and quality of the scientific team and its demonstrated track record
- Enhancement of undergraduate education through involvement in research
- Potential value of the archival database to other users
- Plans to manage data reduction and archiving, and deliver data products, in a timely fashion

To help inform the community, NGSC has created a Web site on the GNIRS Key Science Opportunity (see www.nao.edu/usgp/gnirs_key_sci_op). The site has links to GNIRS information and features a form to allow individuals or groups to register their interest to persons forming science teams.

In addition, NGSC will hold a Webcast on the GNIRS Key Science Opportunity on March 16 at 10:00 a.m. MST. We will briefly review the opportunity, discuss GNIRS commissioning status, and then take questions from the community. In order to connect to the Webcast, or to download the necessary software, visit www.nao.edu/usgp. You are encouraged to send your questions on the GNIRS Key Science Opportunity, before or during the Webcast, to usgemini@nao.edu, or phone them in to 520-318-8421.

As discussed above, NGSC expects the following modes of GNIRS to be offered in semester 2004B: long-slit spectroscopy with resolutions $R=2000$ and $R=6000$, and cross-dispersed spectroscopy at $R=2000$ with continuous coverage from 1 to 2.5 microns.



GNIRS Commissioning

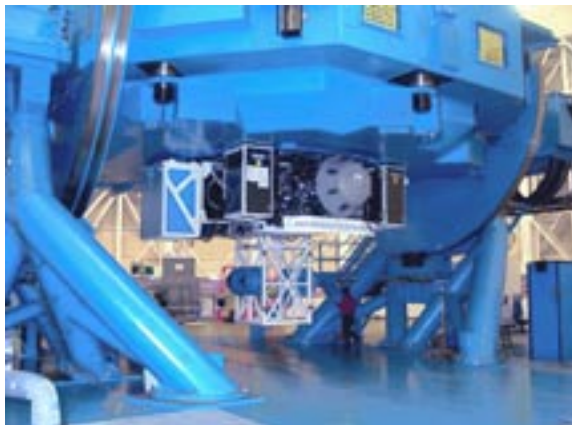
Jay Elias

The Gemini Near-Infrared Spectrograph (GNIRS) final acceptance tests and initial stages of commissioning took place during the nights of 7–17 January 2004. GNIRS is a medium-resolution, 1- to 5-micron spectrograph with long-slit, cross-dispersed, and integral-field capabilities. Overall, GNIRS performed well during the acceptance tests. Problems were encountered interfacing the on-instrument wavefront sensor (OIWFS) software with the Gemini South Acquisition and Guiding system. These problems had not been completely solved at the end of the run, so all observations were carried out using the peripheral wavefront sensors. The OIWFS is expected to be working by the end of commissioning. The first phase of GNIRS system verification will occur in semester 2004A, with the first observations planned for early March.

It seems likely that GNIRS will be offered in semester 2004B in an initial configuration supporting the highest priority modes. The supported modes probably will include: 1) long-slit spectroscopy with resolutions $R=2000$ and $R=6000$ over the full wavelength range; and 2) cross-dispersed spectroscopy at $R=2000$ with continuous coverage from 1 to 2.5 microns. These are the modes for which system verification is occurring during the first half of semester 2004A. The polarization analysis mode will not be available in 2004B.

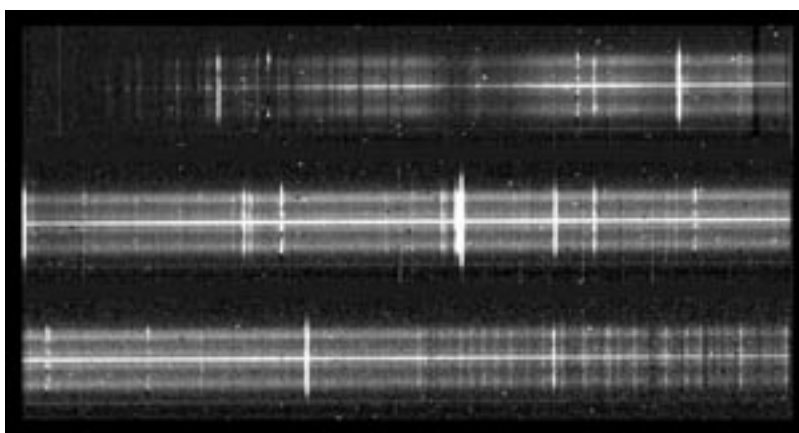
GNIRS currently does not include the integral field unit (IFU). Completion of the IFU, which is being built by the University of Durham, was delayed by a missing optical component. This component has been received, and the IFU is completing final integration and testing. Previous testing over half the field showed good results. The IFU is currently scheduled to be integrated into the instrument in late March after the first system verification run, with initial commissioning on the telescope planned for early April.

Considerable information on the instrument is now available on the Gemini Web pages, and it is being supplemented on an almost daily basis (see www.us-gemini.nao.edu/sciops/instruments/nirs/nirsIndex.html).



GNIRS mounted on the side port of the Gemini South telescope, 12 December 2003.

Our pleasure at the successful commissioning of GNIRS is mixed with sadness at the passing of Richard Elston. Richard was a key member of the team that put together the original proposal to Gemini that led to the GNIRS contract with NOAO; the performance and capabilities outlined above are largely those of the concept he helped put together nearly 10 years ago. Richard undoubtedly would have been one of the more productive users of an instrument he helped to bring about.



GNIRS spectrum of the planetary nebula NGC 2867 at a spectral resolution of 6000. The figure is a mosaic of three grating settings, covering 1.9–2.4 microns, and shows numerous nebular emission lines, primarily H I, He I, He II, and H₂. The observations were obtained by C. Winge (Gemini), J. Elias (NOAO), and A. Ardila (Laboratório Nacional de Astrofísica, Brazil) during the January commissioning run.



Gemini Next-Generation Instrumentation: Progress and Opportunities

Taft Armandroff

The Gemini Partnership began a process in early 2002 to identify the major science opportunities for Gemini in the period 2008–2012 and the required instrumentation to enable Gemini to capitalize on these opportunities. This process included community-based workshops in the Gemini partner countries. 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 30–31 May 2003 in Tempe, Arizona (report available at www.noao.edu/usgp/Tempe_Report_7-8.pdf). Gemini then conducted an international science and instrumentation planning meeting in Aspen, Colorado, on 27–28 June 2003.

The diverse participants in this planning process developed a broadly supported set of major science questions for Gemini’s future:

- How do galaxies form?
- What is the nature of dark matter on galactic scales?
- What is the relationship between super-massive black holes and galaxies?
- What is dark energy?
- How did the cosmic “dark age” end?
- How common are extrasolar planets, including Earth-like planets?
- How do star and planetary systems form?
- How do stars process elements into the chemical building blocks of life?

A detailed report that enunciates these questions and explains how Gemini can play a major role in answering them, “*Scientific Horizons at the Gemini Observatory: Exploring A Universe of Matter, Energy, and Life*,” is circulating in draft form and will be released shortly.

With this draft report, including the instrumentation requirements and estimates of their cost (developed by Gemini, NGSC, and the other national Gemini offices), the Gemini Science Committee (GSC) discussed the Gemini future instrumentation program at its October 2003 meeting. The GSC endorsed the draft “Aspen” report and recommended a core set of future Gemini instruments that it felt enabled the strongest “Aspen” scientific opportunities. The Gemini Board, meeting in November 2003, endorsed the GSC recommendations and worked with Gemini Observatory to define the scope and mechanics of the future Gemini instrumentation program.

As a result of these Gemini Board actions, Gemini Observatory released opportunities for community participation in the Gemini future instrumentation program in December 2003. These opportunities include funded design studies for two groundbreaking instruments and funded feasibility studies for two other frontier instruments. NGSC broadcasted these opportunities to its list of interested instrument builders in the United States, and advertised the opportunities on the NGSC Web page.

The design studies are requested for:

- Extreme Adaptive Optics Coronagraph (wavelength range of 0.9–2.5 microns; the use of either an integral field unit or direct multiband imaging will be among the design options considered; a contrast ratio of $\sim 10^7$ within a 0.1–1.5 arcsec radius of the central target is needed to meet this instrument’s science objectives)
- High-Resolution Near-Infrared Spectrograph (wavelength range of 1.1–5.0 microns; single-slit cross-dispersed seeing-limited spectrometer with $R\sim 70,000$ spectral resolution and providing simultaneous wavelength coverage of as much of the J+H+K or L+M windows as possible; also multi-object MCAO-fed cross-dispersed spectrometer sampling targets across a 2 arcmin field with ~ 3 arcsec long slits, $R\sim 30,000$ spectral resolution, and limited wavelength coverage)

The feasibility studies are requested for:

- Wide-Field Fiber-Fed Optical Multi-Object Spectrometer (wavelength range of 0.39–1.0 microns; field of view of ~ 1.5 degree; spectral resolution of $R\sim 1000$ to $R\sim 30,000$; 4000–5000 simultaneous targets)
- Ground-Layer Adaptive Optics System (field of view of ~ 10 arcmin diameter; desired PSF FWHM of ~ 0.2 arcsec in the J band for 0.5 arcsec seeing in the V band; seek high level of point spread function uniformity over the field of view)

The intent of the design studies is to develop the instrument concepts to the point that fixed-price contracts to fabricate them can be pursued. The intent of the feasibility studies is to establish the technical feasibility of the instruments, develop telescope impact assessments, refine cost estimates, and verify the science case for these instruments. Please see www.gemini.edu/science/aspen/general-announce.html for more information about these study opportunities.

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Gemini Next-Generation Instrumentation continued

In this Gemini procurement, proposals are submitted directly to the Gemini Observatory. The contacts for these opportunities are Doug Simons, Gemini Associate Director for Instrumentation, and Andy Flach, Gemini Contracts Manager. Proposals for design and feasibility studies are due on 31 March 2004. NGSC is aware of significant interest in and expects a very strong response from the US community.

In closing, I would like to acknowledge and thank the numerous members of the US astronomical community (well over 100 people in total) who have contributed to the success of this important planning process by contributing science ideas, participating in the workshops, and helping to define the requirements and cost of the proposed instrumentation.

The Gemini/IRAF Project

Mike Fitzpatrick for the Gemini/IRAF Team

NOAO and the Gemini Observatory are now several months into a collaborative project with the (appropriately) twin goals of improving and enhancing both the GEMINI reduction software and the underlying IRAF system it uses. The key to success in this case is that the partners are not only dedicating new resources to the project, but also the expertise and institutional commitment required to meet its goals—a combined 70 years of IRAF development experience from NOAO, detailed knowledge of the instruments and reduction requirements from Gemini staff, and shared responsibility for development and scientific oversight of the project. The results will benefit not only Gemini users, but will extend to the wider IRAF user community as well.

The core programming group is made up of two full-time equivalents from each institution (three new hires plus existing staff) based in Hilo, Tucson, and La Serena. Inger Jørgensen (Gemini) serves as the Project Scientist, Mike Fitzpatrick (NOAO) serves as Project Engineer, and scientific staff from Gemini and its partner countries will compose a Science Working Group charged with supplying the scientific and functional requirements and oversight for the software. Application development will come largely from Gemini staff responsible for a particular science instrument, teamed with a programmer responsible for the proper implementation of its data reduction package. Experience gained by both sides should lead to more efficient implementation of the data reduction tasks for current and future Gemini instruments.

In general terms, over the course of two years the collaboration will deliver the following items (in roughly this order):

- Enhancements to the core IRAF system, including error handling and improved scripting capabilities in the CL
- 24-bit display support for XImtool

- Improved automatic wavelength calibration capabilities for optical, near-infrared and mid-infrared spectra
- A low-level MEF (Multi-Extension FITS) I/O interface, optimized for Gemini data formats but general enough for all MEF data
- Numerous utility tasks and general application enhancements in both the GEMINI package and core IRAF system
- Compiled-task packages for the reduction of MOS and IFU instrument data, possibly a package for near/mid-infrared imaging
- High-level, script-based packages for instrument-specific reductions

The strategy is to focus initially on providing the core IRAF system and base tools needed to simplify higher-level, instrument-specific application script development in the long term. Simultaneously however, the Gemini/IRAF programmers will be working on new tasks using existing tools to meet the short-term needs of Gemini as new instruments are commissioned.

We expect most of the system infrastructure work to be completed by this summer, when the focus will shift largely to new science applications development. The existing package will undergo a continual evolution throughout the project to make use of new system features as well as to improve the script's efficiency, maintainability, and applicability to new instruments and observing modes. New software will be made available through more frequent IRAF and GEMINI package releases, with the releases being driven both by the data analysis needs of the Gemini community and by the completion of major enhancements to the software.

The Gemini/IRAF programmers visited Tucson this past July for two weeks of intensive IRAF training, and

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The Gemini/IRAF Project continued

NOAO programmers will remain active in the design and implementation of GEMINI tasks as well as serve as a resource for programmer and scientist alike in getting the most out of the IRAF system. The interactions thus far have been very productive, resulting in the GEMINI V1.5 and IRAF V2.12.2 releases in January, and the identification of several new utility tasks that will further simplify and streamline the development process. Work is already underway on these new tasks, the core IRAF enhancements, improvements to the spectroscopy tasks required by GMOS, and the next version of the GEMINI package itself.

New releases of software will be announced on the Gemini and IRAF home pages as they become available. For more information and progress reports, please see iraf.noao.edu and www.gemini.edu/sciops/data/dataSoftwareReleases.html. For more general information about Gemini data, please see www.gemini.edu/sciops/data/dataIndex.html.

The members of the Gemini/IRAF Team are Craig Allen, Andrew Cooke, Mike Fitzpatrick, Inger Jørgensen, Kathleen Labrie, Rob Seaman, Frank Valdes, and Nelson Zarate. Questions may be directed to the Gemini HelpDesk or gemprog@noao.edu.

Gemini Science 2004 Meeting

The NOAO Gemini Science Center invites and encourages US community members to participate in "Gemini Science 2004," the first conference on Gemini science results, on 23–26 May 2004 in Vancouver, British Columbia, Canada.

The purposes of the conference are to:

- Highlight the first four years of Gemini Science
- Promote the unique capabilities of Gemini telescopes and instruments
- Enhance scientific collaboration
- Define new science avenues
- Increase mutual acquaintance among Gemini users

Both verbal and poster presentations will be included. The Scientific Organizing Committee consists of Tim Bedding, Malcolm Bremmer, Stephanie Cote, Katia Cunha, Tom Geballe, Karl Glazebrook, Phil Puxley, Jean-Rene Roy, and Taft Armandroff. US community members should feel free to contact Taft Armandroff (armand@noao.edu) about how to participate in this meeting. Please see www.gemini.edu/science/gem_conf/gem_conf.html for more information about Gemini Science 2004.

NGSC Instrumentation Program Update

Taft Armandroff & Mark Trueblood

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.

NICI is in the integration phase of the project. The dewar and mechanisms have been cleaned and assembled for a "test fit," then sent to a vendor for painting. As of late January, vacuum and cold tests of the dewar and cold mechanisms are imminent. Overall, two thirds of the work to NICI final acceptance by Gemini, which is planned for December 2004, has been completed.

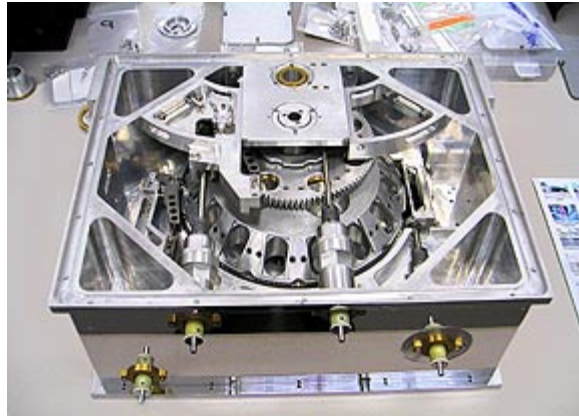
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NGSC Instrumentation Program Update continued

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 the standard Gemini $f/16$ 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. The University of Florida is building FLAMINGOS-2, under the leadership of Project Scientist Richard Elston, Co-Project Scientist Steve Eikenberry, and Project Manager Roger Julian.



The assembled filter/dichroic wheel subassembly for NICI.

FLAMINGOS-2 is in the procurement and fabrication phase of the project. Essentially all of the FLAMINGOS-2 optics have been ordered. Mechanical fabrication is underway in the University of Florida shops and at a few key subcontractors. In addition, fabrication of the detector control and motor

control electronics is underway at Florida. Overall, 31 percent of the work to FLAMINGOS-2 final acceptance by Gemini has been completed.

NGSC Booth at the AAS Meeting in Atlanta



The NOAO Gemini Science Center (NGSC) booth at the January 2004 AAS meeting was the site of much activity. NGSC staff answered questions about how to apply for time on the Gemini telescopes and provided tutorials on the Phase II process. Brochures on the Gemini instruments were available, as was a flyer on the upcoming Gemini Science Conference in Vancouver. From left to right, top: Ken Hinkle (NGSC), Bruce Hrivnak (Valparaiso University), Alan Whiting (NOAO South), Kimberly Ennico (NASA-Ames); center: David Yong (University of Texas at Austin), Taft Armandroff (NGSC), Marcel Bergmann (NGSC), Dara Norman (NOAO South); bottom: Patrick McCarthy (Carnegie Observatories), Roberto Abraham (University of Toronto), Brian Siana (University of California at San Diego), Marcel Bergmann (NGSC).