2012 Annual Progress Report and 2013 Program Plan of the Gemini Observatory

GEMINI OBSERVATORY

Exploring the Universe, Sharing its Wonders

Association of Universities for Research in Astronomy, Inc.

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0 Executive Summary

The activities of Gemini Observatory in 2012 have extended well beyond standard operations that offer the international Gemini community astronomical observations on 8-meter telescopes across the whole sky. In addition to scientific discoveries that span the Universe from the Solar System to the largest scales of cosmology, the Observatory and its partners made significant progress on major new instrument projects, including conducting initial observations with unique and world-leading instruments such as the Gemini Multi-Conjugate Adaptive Optics System (GeMS). Fundamentally Observatory operations are changing in preparation for the withdrawal of the United Kingdom (UK) from the Partnership at the end of the year. Some of these "transition" activities have already begun, and they will be a major element of the program for 2013. Accomplishments in 2012 and plans for the near future aim to maximize the scientific return of Gemini and the service it provides to users, within the limitation of the decreased budget, which requires the reduction of some services.

Following a brief introduction (Section 1), this report presents science highlights based on user publications during the year (Section 2). These results demonstrate the success of a nimble and adaptable observatory. Astronomers take advantage of the flexible scheduling of observations and the possibility of interrupting immediately during the night with targets of opportunity. Some of the key results thus rely on exploiting the time domain, such as capturing supernovae as they fade after their initial bright explosions, and urgent confirmation of the disappearance of the dusty planet-forming disk around a star. Visiting instruments provide further flexibility for users and exploit existing hardware. The success of a one-week visit of the specialized Differential Speckle Survey Instrument to Gemini North has already yielded important scientific conclusions about the sizes of Pluto and Charon and the existence of closely-separated binary stars, with the prospect of confirming planetary-mass companions to other stars after the observations are fully analyzed.

Section 3 reports the activities within Observatory operations. This area includes the fundamental daytime preparations and nighttime usage of the telescope and instruments, along with scientific support of users. The publication rate based on observations with Gemini facilities is stable. Gemini North publication rate exceeds that of Gemini South. The Observatory continues to dedicate effort to enhance relationships with users, with the triennial international Science and User Meeting and the initiation of the Users' Committee for Gemini representing key accomplishments in this area during 2012.

Several large projects provide new capabilities for users. A major upgrade was completed to improve the software packages that astronomers use to propose and plan their observations. The user data reduction software for new instruments (FLAMINGOS-2 and the Gemini South Adaptive Optics Imager) was delivered. Initial trials of user eavesdropping, which allows remote users to participate in observing that the Gemini staff conduct, began in December. Other software improvements will improve the overall efficiency of the Observatory. Specifically, changes for the semester-long planning and filling of the observing queue will improve the likelihood that accepted programs are executed, which ultimately supports user satisfaction. The data quality assessment pipeline now provides tools for nighttime observers to rapidly evaluate observations in real time. Automated measurements of some of the most common observing modes are

in place. Future work will increase the number of instruments and modes, and the infrastructure of these tools will serve as a common foundation for user data reduction tools that instrument teams develop. Another significant activity within Operations is the training of non-research observers, which is part of the Transition Program. They will conduct about half the queue-scheduled observations in 2013.

Within Engineering Operations, improvements to the near-infrared spectrograph GNIRS were a major project in addition to regular activity. The instrument is back on the Gemini North telescope and used for science observations, with the results of more reliable mechanisms and reduced background with the removal of radioactive lens coatings. Outstanding work for 2013 will be the replacement of a cracked lens in one of the camera barrels. A significant accomplishment for the Gemini South telescope operation is the full use of the azimuth tape encoder system; a remaining challenge to resolve at Gemini North is a persistent vibration problem. Operations metrics are presented in Section 3.4. Overall, the program completion rates are good. The oversubscription of Gemini North remains healthy. With limited instruments, Gemini South has had a low oversubscription rate. At Gemini North, the instrument requests are diverse, with less than half the time requested on the optical facility GMOS-N. In contrast, GMOS-S accounts for more than 75% of requests on Gemini South. The total fault loss rates continue to be less than 4% at both sites. NIRI and Altair are significant sources of faults at Gemini North, and the telescope and enclosure account for more than half the faults at Gemini South.

The instrumentation development program contains Gemini's most significant instrumentation projects, including both completely new capabilities as well as large upgrades to existing facilities (Section 4). The three highest-priority projects will all provide new capabilities for Gemini South: GeMS (described above), the near-infrared imager and spectrograph FLAMINGOS-2, and the extremely high-contrast adaptive optics instrument Gemini Planet Imager (GPI). GeMS showed significant progress with the beginning of technical commissioning at the beginning of the year, which included end-to-end operation using the science instrument, the Gemini South Adaptive Optics Imager (GSAOI). A planned shutdown period during the middle of 2012 achieved many of its goals, including improving reliability of the laser system, but a remaining challenge is the performance of the natural guide star wavefront sensor, which limits the fraction of the sky that is observable with GeMS.

FLAMINGOS-2 suffered the greatest setback following initial on-sky commissioning in January, with the fracture of the main collimator lens in February. A new lens and spare have been procured, and the lens mounts have been modified to reduce risk of damage to the lenses. Taking advantage of this laboratory work on the instrument, significant electronic improvements to increase thermal stability and protect the detector have been implemented. We currently estimate that FLAMINGOS-2 will be back on the Gemini South telescope in early 2013.

An external team leads the development of GPI. They have integrated the subsystems and demonstrated high contrast in end-to-end tests. A recent setback is the failure of an actuator of the deformable mirror. Remediation efforts introduce a delay of several months, with GPI now expected at Gemini South in the first half of 2013.

Two important activities aim to deliver high-resolution optical spectroscopy capabilities to Gemini. In the near term, GRACES will provide a fiber link to use the large Gemini North

telescope aperture with an existing spectrograph at the Canada-France-Hawaii Telescope. The first experimental phase for science observations is scheduled for 2013. The Gemini High-Resolution Optical Spectrograph (GHOS) is a completely new instrument, to be delivered on a timescale of several years. This year saw the conclusion of the competitive conceptual design phase for GHOS. The selected team will be announced soon, after the contract for the next phase is in place.

Gemini aims to broaden participation in science and technical fields and to inform the general public about our activities, especially in the local communities of our telescope sites, as Section 5 describes. The flagship public outreach programs, *Journey Through the Universe* in Hawai'i and *Viaje al Universo* in Chile, attracted over 20,000 participants in 2012. School visits of the portable StarLab planetarium reached nearly 5,000 people in Hawai'i and Chile. The Public Information and Outreach department is now concentrating on improving communication with users and the public, especially through increased use of social and new media. To maintain a diverse staff, Gemini is improving recruitment practices, especially to mitigate conscious and unconscious bias, and we support regular internship programs and local initiatives to develop the workforce for the future.

Section 6 describes the Gemini organization and budget. The search for a permanent Director has concluded, with Markus Kissler-Patig now in place. Many administrative functions have been transferred to AURA's Centralized Administrative Services and are no longer supported by Gemini staff. The projected staff size will continue to reduce over the next years, both to accommodate the budget reduction and as a consequence of this shift of effort.

In $1000	**2012 Budget**	**2012 Actual** (as of 09/30/12)	**2012 Forecast and Commitments** (as of 12/31/12)	**Variance (Forecast vs. Budget)**
O&M	30,362	19,915	28,226	(2,136)
IDF	8,413	3,188	5,516	(2,897)
FDF	1,505	632	1,231	(275)
SBF	44	76	76	33
SPEC	50	83	95	45
Totals	40,374	23,894	35,145	(5,229)

Table 0-1: Budget summary, by fund.

Table 0-1 provides a summary of the 2012 budget by fund: Opera-tions and Maintenance (O&M); Instru-ment Devel-opment Fund (IDF); Facilities Development Fund (FDF); Southern Base Facility (SBF, for capital expenditures, not operating expenses); and the small special grants and awards fund (SPEC), which contain individual investigator grants. The planned 2012 Budget, approved by the Gemini Board in May 2012, reflects a deliberate effort not to spend the full annual contributions of the Gemini Partners, to provide surplus funds to smooth the transition to operations without the participation of the UK. Some of the further unspent budget is the result of actively reducing spending in discretionary areas, such as travel, supplies, and equipment. Reallocation of staff effort to instrument projects (supported by the IDF and FDF) is also significant. Most of the IDF variance is due to contract payments that are postponed until 2013 because of vendor delays, the largest of which is GPI. The primary source of variance in the FDF is delays in the project to deliver improved acquisition and guiding units.

Future plans appear in Section 7. The long-term Transition Plan, which reaches a sustainable state for operations and development in 2016, sets the context for the

specific activities scheduled for 2013. Core elements of the future operations are: to offer four instruments plus adaptive optics at each site; to have non-research observers conduct the majority of queue-scheduled observations; to provide less effort for instrument and facility development, which requires the delivery of functional facility-class instruments from vendors; and to reduce staff effort to provide queue observing. Operating with a reduced budget requires significant reductions in staff numbers, along with savings across all areas of non-labor spending.

Work that is directly associated with the Transition Plan comprise a major component of Gemini's program plan for 2013. Management of the program will introduce more rigorous monitoring tools and metrics. Two important software-dominated activities will be to make compliance with laser guide star clearances more efficient during nighttime observing and an upgrade of the observing control systems infrastructure, which will reduce maintenance burden and facilitate further improvements in the future. Long-term projects that will continue beyond 2013 include progress toward base facility operations and additional capabilities of the quality assessment pipeline.

The conclusion of several major development projects should result in important new instrument capabilities for science use in 2013. These include GeMS with GSAOI, FLAMINGOS-2, GRACES, and GPI in commissioning phase. Users will also directly benefit from software deliveries, especially the new foundation for data reduction. Many of the significant operations projects will be less directly evident to users, such as the primary mirror recoating at Gemini North, though they will deliver better performance.

1 Introduction and Overview

Gemini Observatory's mission is

> *To advance our knowledge of the Universe by providing the international Gemini Community with forefront access to the entire sky.*

This annual progress report shows the 2012 activities toward fulfilling this mission. The starting point is the twin 8-meter telescopes and their instrument capabilities that are available to the user community. The Gemini user community's scientific interests range from the Solar System to the most distant galaxies and quasars, and Gemini Observatory's variety of optical and infrared imagers and spectrometers are sufficiently flexible to enable this broad range of exploration. More specialized capabilities—such as the current NICI and the upcoming GPI (both designed for planet-hunting)—also are (or will soon be) available for general use.

Gemini offers both queue and visitor ("classically-scheduled") observations according to user choice. The queue makes targets of opportunity a regular and popular mode of use. Gemini supports astronomical researchers from preparation of observations through data reduction to enable efficient and effective scientific return. The Gemini data archive, which includes calibrations, is open to everyone after an eighteen-month proprietary period for the original investigators.

Against this backdrop of regular operations, observatory staff and our community partners continue to work toward the delivery of new capabilities. This year marked an active period for continued development of the Gemini Multi-Conjugate Adaptive Optics System (GeMS), with the start of commissioning and plans for system verification programs. We have suffered setbacks with FLAMINGOS-2, so this instrument remains a work-in-progress, not yet a facility offering. In the effort to bring high-resolution optical spectroscopy capabilities to Gemini, 2012 marked successful progress toward the Gemini High-Resolution Optical Spectrograph (GHOS), with completion of the competitive conceptual design review.

With the end of 2012, we also reach the end of the participation of the United Kingdom, one of the founding members of the international partnership. Gemini as a whole will miss the contributions of this active and productive scientific community. The corresponding budget change requires a fundamental shift in Gemini operations and service delivery, which we will execute as the Gemini "Transition" through 2015.

This report begins with highlights of scientific results (Section 2). Section 3 describes progress in science and engineering operations. Instrument development activity during the year is covered in Section 4. Results from the active education and public outreach program appear in Section 5. It concludes with an organizational and budget summary (Section 6) and a program plan for 2013 and future years, through the Gemini Transition (Section 7).

2 Science Highlights

To produce great science, Gemini's users take advantage of a variety of capabilities that span a breadth of wavelength coverage, spatial resolution, and spectral resolution, making effective use of Gemini's flexibility, especially for time-critical data.

2.1 Highest Resolution Optical Images of Pluto from the Ground

Using the visiting Differential Speckle Survey Instrument (DSSI) at the end of July 2012, S. Howell (NASA Ames Research Center) and his team obtained the highest resolution ground-based optical images of the Pluto-Charon system (Figure 2-1), which yielded accurate measurements of the objects' diameters (2012 *PASP* 124 1124). The team spent approximately one week at Gemini North, using 10 hours on sky, allocated as Director's Discretionary Time.

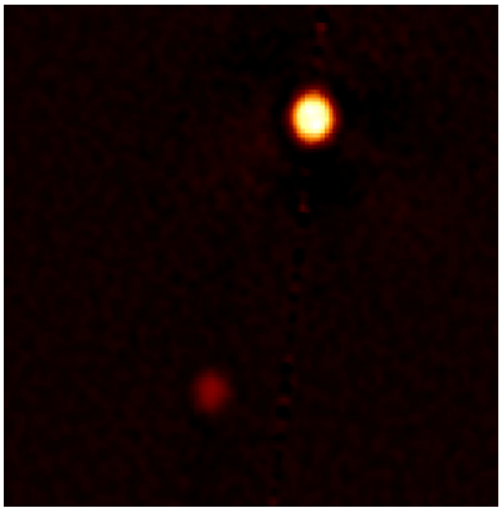

Figure 2-1: Speckle image reconstruction of Pluto and Charon at 692nm. The image is approximately 1.4" across.

The primary science objective of the program was to follow up on candidate planetary companions discovered by the Kepler and CoRoT spacecraft, and additional observations provided orbital measurements of close binary stars (Horch *et al.*, 2012 *AJ* 144 165). The resolution achieved was tens of milliarcseconds, with sensitivity to magnitude differences greater than 6 in many cases. These observations can reveal background binary stars that would appear as transits in the sensitive lightcurves measured from space. The DSSI team is scheduled to visit Gemini North again in the middle of 2013, making DSSI available as a visiting instrument for general use.

2.2 Dynamical Measurements of Extremely Massive Black Holes

Nicholas McConnell (University of California at Berkeley) and collaborators measured some of the most massive black holes at the centers of cosmologically nearby galaxies, and some of these results disagree with earlier predictions of black hole mass (McConnell et al. 2012 *ApJ* 756 179). The most massive galaxies are predicted to host the most massive black holes, and very massive galaxies are located at the centers of clusters of galaxies. The richer the cluster, the more massive the central galaxy and corresponding black hole. Thus, rich clusters are the place to find massive black holes.

The detailed relationship between a galaxy and its black hole may depend on the galaxy's environment. This work follows on the initial discoveries of billion solar mass black holes (McConnell *et al.* 2011 *Nature* 480 215) to observe more galaxy clusters and probe a range of environments. The overall conclusion is that the masses of the largest black holes exceed previous predictions, such as those based on the scaling of a galaxy's central black hole with the velocity dispersion of stars in the galaxy's bulge (Figure 2-2). The general relationship points to an underlying fundamental principle of galaxy formation, probably related to the dark matter halos in which galaxies reside. The discrepancies with the empirical correlations imply that further details about the evolution of massive galaxies remain significant.

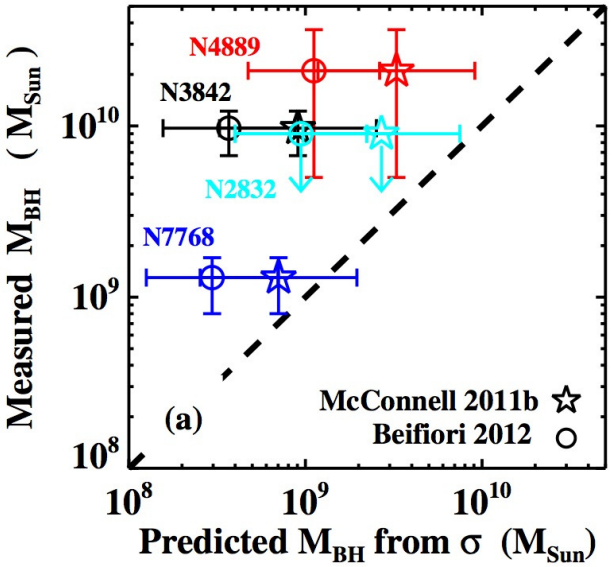

Figure 2-2: Measured black hole masses compared with two predictions based on the relationship with stellar velocity dispersion, σ. The massive galaxies here show larger black hole mass than the predictions.

Determination of the black hole masses requires comparison of stellar kinematic models with observations that span a range of physical scales. Data obtained using the integral field unit of the Gemini Multi-Object Spectrograph (GMOS) on Gemini North provide excellent measurements on the smallest (subarcsecond) scales for this work.

2.3 The Best Standard Candle for Cosmology

Exploding stars (supernovae) offer the most precise measurements of large cosmic distances. Of these, type Ia supernovae observed at near-infrared (NIR) wavelengths provide the greatest precision as "standard candles" for measuring cosmological distances.

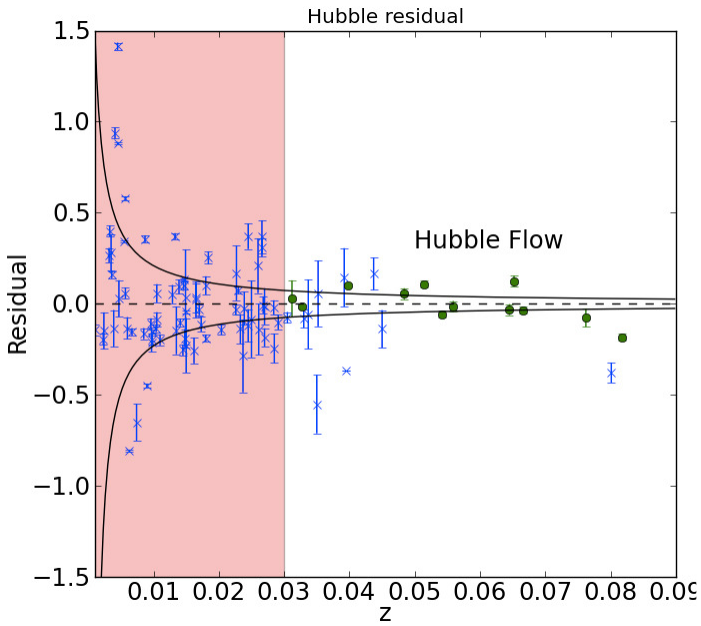

Figure 2-3: Residual Hubble diagram for supernovae observed in the *H* band (green), compared with previous NIR samples (blue). The deviation of each measurement (measured in magnitudes) from the overall mean is plotted against redshift, z. The solid black lines show the effect of peculiar velocity of ±300 km/s.

Observations of type Ia supernovae at optical wavelengths are frequently used for this purpose and are the basis for the research leading to the 2011 Nobel Prize in Physics. However, these supernovae have intrinsically variable luminosities at optical wavelengths, so the luminosities must be standardized, using the empirical relationship that supernovae that fade away more slowly are brighter. Optical light also suffers from the complication of attenuation by dust anywhere along the line of sight, from the supernova's host galaxy to our vantage point in the Milky Way.

In contrast, the near-infrared peak luminosity of type Ia supernovae offers the advantage of being intrinsically more consistent, and the effects of dust are diminished compared with optical emission. New work based on observations using the Near Infrared Imager and Spectrometer (NIRI) on the Gemini North telescope results in measurements of cosmological distances to an accuracy of 5% (Barone-Nugent *et al.* 2012 *MNRAS* 425

1007). Such precise measurements are essential to the continued study of the expansion history of the universe and hence constrain the nature of dark energy.

This work is restricted to relatively distant supernovae, at redshifts $0.03 < z < 0.09$, so the overall expansion of the universe (the Hubble flow) determines the motion of their host galaxies, independent of local peculiar motions. While earlier work had already indicated the greater uniformity of supernova emission in the NIR, this is the first significant study to obtain high-quality measurements of supernovae in the Hubble flow (Figure 2-3).

2.4 Beginning to Solve the Cooling Flow Problem

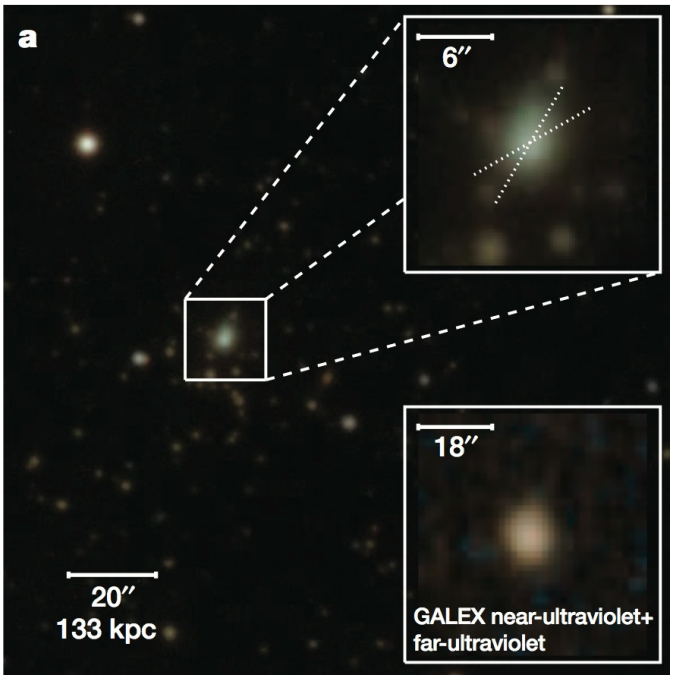

Figure 2-4: False-color composite of the Phoenix Cluster, from images at *r, i,* and *z* band obtained at the Blanco telescope. The central galaxy (top inset) is significantly bluer than the other cluster members, which indicates active star formation. Ultraviolet emission, which is also characteristic of star formation (bottom inset), reveals only the central galaxy.

Clusters of galaxies are full of hot gas that emits copious X-ray radiation. This emission should lead to a "cooling flow," whereby cooling material sinks to the dense center of the cluster. In turn, this inflowing reservoir of relatively cool gas is expected to stimulate star formation in the galaxy located at the cluster's core, rather than result in runaway cooling of the cluster gas. The problem, until now, is that such central galaxies have been observed to be quiescent, showing little evidence for ongoing star formation.

Michael McDonald (Massachusetts Institute of Technology) and colleagues have now detected the first evidence for significant cooling-flow-induced star formation in a central cluster galaxy, in the cluster designated SPT-CLJ2344-4243 (McDonald *et al.* 2012 *Nature* 488 349; Figure 2-4). The cluster itself was detected with the South Pole Telescope. Spectra obtained using GMOS at Gemini South provided some of the first hints that the central galaxy was unlike the red well-formed elliptical galaxies typical of cluster cores along with additional measurements of other members of the cluster to determine the baseline redshift ($z = 0.6$) for comparison of other observations. The more complete analysis of the so-called "Phoenix Cluster" and its central galaxy emerges from observations spanning X-ray to far-infrared energies. The central galaxy possesses an active nucleus in addition to star formation at a rate of 740 M_{Sun}/year. The star formation rate is still too low to prevent runaway cooling, given the measured cooling flow rate of 3800 M_{Sun}/year, suggesting that the feedback mechanism is not fully established in this example. Nonetheless, the high star formation rate points to this mode of star formation from intracluster gas as an important element

of galaxy formation, in addition to galaxy mergers, which had been widely considered previously.

2.5 A Disappearing Dusty Disk

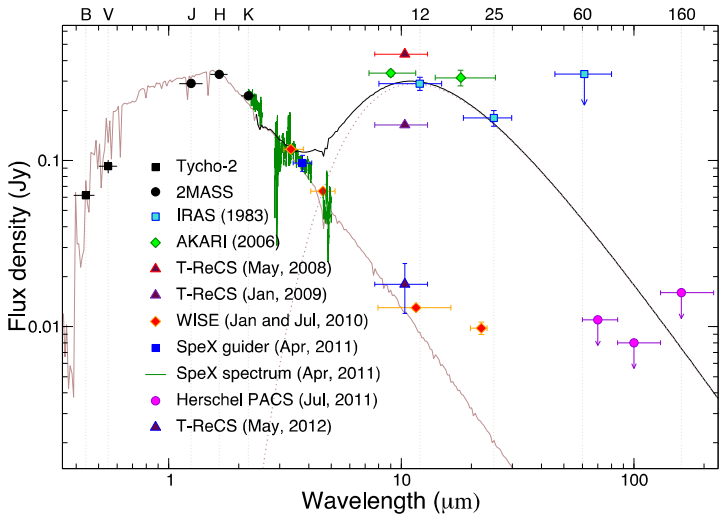

Figure 2-5: Evidence of the disappearance of a dusty debris disk in the spectral energy distribution of TYC 8241 2652, which shows the decline of mid-infrared emission from 2008 to 2010 and persists today.

The dusty disk of TYC 8241 2652 has disappeared. For decades, warm dust emission had been evident in the spectral energy distribution of this young solar analog, as a strong peak at mid-infrared wavelengths demonstrated. Over the course of two years, the mid-infrared flux decreased by a factor of 30 (Melis *et al.* 2012 *Nature* 487 74; Figure 2-5). The emission persists in this low state, as recent observations using the Thermal-Region Camera Spectrograph (T-ReCS) on Gemini South show.

The dust emission around stars is significant as a connection to planetary formation. Small solid bodies form out of the remains of star formation. Collisions and reprocessing of objects such as comets and asteroids leave dusty material in a debris disk. In the current work, there is no secure explanation for the disappearance of the dusty disk. Suggestions include radiative evaporation, accretion onto the central star, or blow-out by a wind, but none provides a conclusive result.

2.6 Gas Morphology and Kinematics of Sub-Millimeter Galaxies

Galaxies identified at sub-millimeter (sub-mm) wavelengths are important contributors to the cosmological epoch of star formation at redshift z~2, with star formation rates exceeding 1000 M_{Sun}/year in many cases. Detailed analysis of the properties of these galaxies, however, requires observations at other wavelengths. The rest-frame optical emission provides emission lines for investigation of gas dynamics, and Hα in particular is linked to measurements of star formation in local galaxies.

In a significant sample probing sub-mm galaxies at 2.0 < z < 2.7 on kiloparsec scales, Susannah Alaghband-Zadeh (University of Cambridge) and collaborators use the integral field capability of the Near-Infrared Integral Field Spectrometer (NIFS) to find evidence for strongly dynamical systems and multiple kinematic components in the Hα data (Alaghband-Zadeh *et al.* 2012

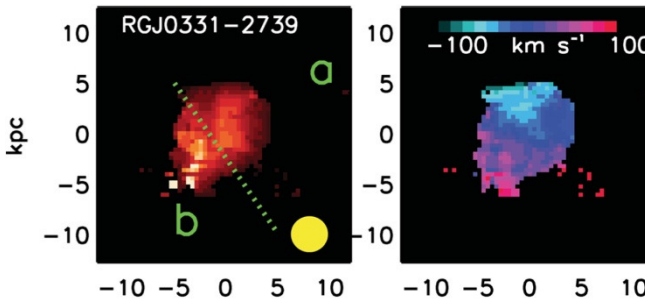

Figure 2-6: Hα intensity image (left) and velocity dispersion map (right) of the identified z=2.3 sub-mm galaxy shows two distinct components (a and b). The yellow circle indicates the observed point spread function.

MNRAS 424 2232; Figure 2-6). Some of the sub-mm galaxies are disk systems, and others show evidence for mergers, and collectively they show stronger star formation than optically- and UV-selected galaxies at comparable redshift.

2.7 No Intermediate-Mass Black Hole at the Center of M71

The dense environments of globular clusters may be the homes of intermediate-mass black holes, those with masses of around several 100 to 10^4 M_{Sun}. R. S. Samra (University of British Columbia) and colleagues have used NIRI with the Altair adaptive optics system on Gemini North for observations in the *H* and *K* bands to measure the proper motions of M71, which is located at a distance of only about 4kpc. (Samra *et al.* 2012 *ApJL* 751 L12). The original observations were made in 2005, with subsequent observations in 2007 and 2009 (Figure 2-7). Over the longer time baseline, the proper motion dispersion of the central stars is observed to be 179 ± 17 microarcseconds per year.

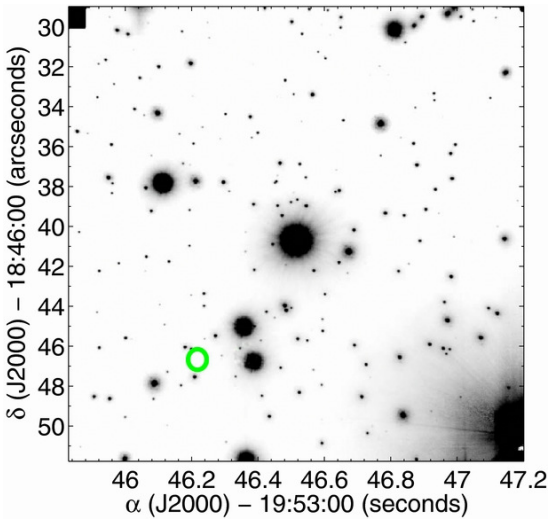

Figure 2-7: Core of M71 in the *H* band, observed with NIRI/Altair on Gemini North. The cluster center is marked with a green circle.

The search for evidence of a black hole begins with measurement of proper motion dispersion as function of distance from the center of the cluster. In the presence of a black hole, the dispersion would increase toward the center. Grouping the data into radial bins, the team finds that the proper motion dispersion is instead constant, despite the small central bin, which is less than 5 arcseconds in radius. Alternatively, comparing the observations with a model system that includes a black hole and stars results in an upper limit on black hole mass of 150 M_{Sun}. Thus, although M71 presents the opportunity for high resolution measurements, it does not appear to hold an intermediate mass black hole in its core.

3 Operations

3.1 Gemini Publications and User Relationships

The rate of publication based on Gemini data decreased slightly in 2012, with 166 papers appearing in refereed journals (Figure 3-1). A large fraction (about 40%) are based on observations from more than one program. A significantly larger number of publications rely on observations with Gemini North (106), compared with those using Gemini South (79). Members of Gemini's science staff are first authors or co-authors on 26 (16%) of these papers in 2012, and contributed an additional 35 refereed publications not based on Gemini data. Three individuals who participate in long-standing, significant external collaborations account for half the papers not based on Gemini data, and most of the others emerged from work initiated prior to the authors' arrival at Gemini. Overall, the active participation of Gemini astronomers in the broader scientific community and making use of all available (and appropriate) facilities is healthy. Appendix A contains a complete list of the 2012 staff publications, and all refereed publications based on Gemini data are listed in Appendix B. Appendix C provides more detail about research staff members' accomplishments and plans.

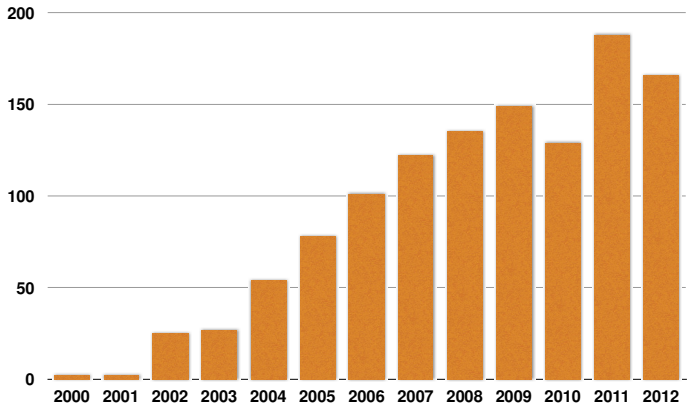

Figure 3-1: Rate of publication based on data from the Gemini telescopes.

Gemini continues to develop relationships with partners and the international user communities. Recent events have focused on service to users. Improved user software for observing was introduced in early 2012 and is described further below. The Gemini Science and User Meeting in San Francisco in July 2012 provided an opportunity for the international community and Observatory staff to join together, with over 100 attendees from all Gemini partners. Results came from a range of scientific areas, from the Solar System to the largest scales of the Universe. The user discussion sessions were lively and well-attended. Many of the questions and concerns were related to new instrument capabilities and adaptive optics. Options for large programs and a faster (peer-reviewed) proposal cycle were also discussed.

The Users' Committee for Gemini (UCG) completed its first regular meeting in October 2012, in La Serena. This committee reports to the Gemini Director and is charged to provide feedback on all areas of Observatory operations that affect current users. Both Gemini and the UCG may raise issues for the committee's consideration. Key topics from Gemini this year were user communication and a rapid, peer-review time allocation process. The UCG conducted an on-line survey and found data reduction to be the most common user complaint. The specific problem noted was the difficulty in identifying and obtaining calibrations appropriate to science observaitons. Current

survey reactions to the latest versions of user software, including the Phase I Tool, Observing Tool, and data reduction package, are more positive than the responses to a similar survey in 2008. Gemini action responding to several recommendations of the UCG is already in progress; *e.g.*, plans for a users' forum and eavesdropping (described below). Future plans to improve the calibration association in the Gemini Science Archive, based on a system already in place within the Observatory, should address this difficulty. In addition, elements of the data quality assessment pipeline software (described below) and additional cookbooks should help users reduce their data. The Observatory expects to receive the final committee report and recommendations soon and will post it along with the Gemini response. Also, the current committee (of seven) will be expanded by the time of next year's meeting.

3.2 Science Operations

Major activities established as part of the 2012 program plan within Science Operations are listed in Table 3-1. This section reports on progress with these activities, identifies changes and decisions taken within the year, and includes information on other significant activities carried out in 2012.

Science Operations 2012 planned activities
Provide web-based ITAC software (replacing the legacy system of spreadsheets)
User software: complete first stage of Phase I/II software project
QA Pipeline: expand mode coverage
Data reduction: complete packages for FLAMINGOS-2 and GSAOI
Continue science operations training and documentation (transition)
Additional Science Operations 2012 activities
Complete NICI Campaign and release data
Test remote eavesdropping

Table 3-1: 2012 Science Operations activities.

3.2.1 ITAC Software and Queue Filling Results

Stage 1 of the International Time Allocation Committee (ITAC) software project was complete at the end of 2011 and improved queue filling commenced in semester 2011B. The new algorithm schedules queue programs on an observation-by-observation basis. The time available at certain RAs is reduced according to known shutdowns, commissioning, and rollover observations. The queue is more accurately filled, and we no longer over-fill popular RAs such as the RA-12 region in "A" semesters at Gemini North. Partner ITAC representatives replace targets or relax observing constraints as necessary, to schedule programs. We have worked through the backlog of rollover programs from semesters prior to this implementation, and for 13A the rollover impact on the queue is about half that of previous semesters.

Also starting in 2011B, fewer queue proposals were scheduled in Band 3. Each partner's queue time is filled to 80% with Band 1, 2, and 3 programs. A new cloud cover constraint of CC80 has been defined, corresponding to one magnitude of extinction, or 40% transmission. The remaining worst-conditions time is used by Band 4 poor weather proposals, and this time is not charged to the partners. The band boundaries are drawn as before at 30% and 60% of the total available queue time, so that the amount of Band 3 time is halved compared to previous semesters. The improved queue

Telescope	**2011B**	**2012A**
Gemini North	4%	2%
Gemini South	9%	5%

Table 3-2: Classical observing fractions at the two telescopes for 2011B and 2012A.

filling results in fewer disappointed Band 3 principal investigators (PIs), while still providing a sufficient variety of buffer observations for the semester. The 2012 target for the ITAC software itself was to complete a number of remaining features and make the system robust so that it would require essentially no software support during the run up to, and in the course of, the 13A ITAC meeting. Due to staff departures in the software group, this target has not yet been reached, and the 13A ITAC meeting was supported by software engineers. Classical observing remained between 5 and 10% of all science allocations, as shown in Table 3-2.

3.2.2 User software improvements

The extended and large project to upgrade the Phase I and Phase II software tools produced its first products toward the end of 2011. These tools were in use for the 2012A preparation process and a second stage of improvements (both pre-planned and based on user feedback) were put in place in time for 2012B. The main benefits were the following.

- **Significantly revised Phase I tool**
  - Completely rewritten with a more modern and user friendly interface.
  - Supports creation of nearly execution-ready skeleton observations.
  - Provides wizards with decision trees to aid users with instrument configurations.
  - PDF attachments using partner-specific LaTeX or Word templates.
  - Eliminates required guide star selection in favor of guide star probabilities.
  - Automatically checks the Gemini Science Archive (GSA) for duplicate observations.
  - PDF science case uploads.
  - Improved handling of non-sidereal targets and Targets of Opportunity.

- **Phase II improvements**
  - Templates allow simple creation of nearly execution-ready observations.
  - Support for Altair laser guide star + Peripheral Wavefront Sensor 1 (LGS+P1).
  - Support for GMOS custom regions of interest.
  - Many improvements to Phase II checks, including override capabilities.
  - Automated guide star searches (for GMOS for 2012A, for all instruments for 2012B).
  - Smart GCAL calibration, replacing previous manual selection of calibration parameters.
  - Automated guide star asterism finding (and Strehl maps) for GeMS/GSAOI.
  - Fetch/store password persistence.
  - Phase II skeleton creation using Phase I information.

Phase II is now also supported by Digitized Sky Survey catalogues hosted at Gemini and accessible in the Phase II tool (the Observing Tool).

3.2.3 Quality Assessment Pipeline and Data Reduction

The goal of the quality assessment (QA) pipeline is to provide rapid data quality assessment at the telescopes during nighttime observing. The following capabilities were added to the pipeline on both summits in 2012, both as planned projects and in response to priorities of staff scientists after the initial release in late 2011:

- Flux calibration in the GMOS imaging modes;
- Sky transparency measurements in GMOS imaging mode;
- Sky background level measurement in GMOS imaging mode;
- Astrometry in GMOS imaging mode;

- Automatic file pickup;
- QA metric graphical user interface for nighttime use.

Other declared goals for 2012 included the completion of data reduction user packages for FLAMINGOS-2 and GSAOI in advance of System Verification. These two packages were indeed released in time, although as reported elsewhere in this report, the commissioning activities for both instruments have been delayed.

The FITS Storage system, which is the local repository for all data taken on the telescope and forms the basis for the calibration system employed by the QA pipeline, has been in continual use for more than a year now. With maintenance and other documentation completed, the formal project will be closed at the end of 2012. The FITS storage work is a component of the QA pipeline project.

3.2.4 Science Operations Training and Documentation

A significant element of the Gemini Transition Plan is for a non-research group—the Science Operations Specialists (SOSs)—to carry out 75% of nighttime queue observing, thereby reducing the *number* of research staff (although retaining the fractional research effort of these individuals). The SOS groups are also responsible for data quality checking and telescope operation, and they are now nearly fully staffed in both the north and south. Some of the SOS members are new to the observatory, and some are drawn from pre-existing groups (specifically the Data Analysis Specialists and Systems Support Associates). The groups include a range of expertise, experience, and qualifications including Ph.D. in Astronomy. Training reached 60% completion in the South and 75% completion in the North during 2012 across all SOS tasks. In Semester 12B at both telescopes, SOSs will conduct approximately 30% of the queue observing at night. It is planned that within 2013, this level will reach or exceed 50% at both telescopes. An outstanding challenge will be the possibility of higher turnover among this group, and we are developing strategies to ensure that the positions remain fully staffed at all times.

3.2.5 NICI Campaign

Although not explicitly declared as a major goal in the program plan for 2012, the Near-Infrared Coronagraphic Imager (NICI) Campaign anticipated and achieved completion by the end of 2012A. Since the Call for Proposals for 2012B, PIs have been able to apply to make observations of the previously-restricted Campaign targets. As with all targets, time allocation committees will avoid granting time to observations that approximate the observing mode and depth achieved by the Campaign, unless the science case specifically justifies why these new observations are necessary. All Campaign observations taken before May 2011 became publicly available via the Gemini Science Archive (GSA) on November 24, 2012.

3.2.6 Remote Eavesdropping

Although not explicitly declared in the 2012 plan, a model for remote eavesdropping was developed in response to feedback from the Science and Technology Advisory Committee (STAC) and tested during semester 2012B on select programs. Eavesdropping enables a distant PI to take part in a queue observation, commenting on target acquisition and assessing incoming data, for example. The expected benefits of eavesdropping are improved relationships between the user community and Gemini, better user understanding of data acquisition and observing procedures, and more efficient use of telescope time.

If an eavesdropping program comes up on a given night, the PI or designated contact receives a phone call when observations are about to begin. The "eavesdropper" uses Skype and a web browser to communicate with the summit observer and has direct access to data on a dedicated server. Modification of the program—*e.g.,* deciding to continue or terminate an observation—is possible, within the confines of the nightly queue plan. If the completed tests prove successful, eavesdropping will be regularly implemented for 2013A.

3.2.7 Storage and Archiving

Statistics for activity and data ingestion in the Gemini Science Archive are given in Table 3-3. The contractual uptime requirement for the GSA is 98%, and was exceeded in all three quarters reported so far this year.

Period	Helpdesk Tickets Resolved	Dealt with by Gemini staff	Web Hits	Queries	FITS images ingested	Proprietary data users	Uptime
Jan-Mar	42	31%	73637	34409	49334	1250	98.1%
Apr-Jun	22	27%	71176	33384	59395	1280	98.7%
Jul-Sep	13	8%	87511	48160	82061	1314	99.9%

Table 3-3: Gemini Science Archive statistics.

3.3 Engineering Operations

3.3.1 Instruments

Planned remedial engineering of the Gemini Near-Infrared Spectrograph (GNIRS) was completed and addressed the mechanical reliability of various mechanisms, including the acquisition mirror and grating turret. Engineers and scientists performed the main work, testing, and calibration over a four-month period. The instrument is back on the telescope after successful lab testing and is used for science observations. One of the outstanding issues—replacement of camera lenses with non-thoriated-coated lenses—was not completely resolved because a crack was discovered in one of the other lenses in the short-red camera barrel. The risk of the crack's propagating was deemed too great to leave the lens in place, so this lens will be replaced during a short engineering break (approximately one month) in the northern summer of 2013. The thoriated-coated camera lens in the popular short blue camera was successfully replaced, leading to a factor of ~40 decrease in the rate of radiation events on the detector.

GMOS-S has suffered for some time from a bubble in the thin oil interface between two lenses in its optical system. In early 2012, this problem appeared to intensify and produce measurable throughput effects (variable across the field of view) at some relatively extreme orientations of the instrument. Work to remove this bubble was done during the shutdown in August 2012. The work was complicated by the fact that the bubble was in a lens system whose refill port was placed below the barrel. The solution was to develop a new procedure to invert the instrument in the lab and fill from above. GMOS-S throughput has now returned to nominal values.

T-ReCS proved to be very unreliable in operational use in 2012, needing to be removed from the telescope twice for remedial work on its slit mechanism. Ultimately this work was successful, though because the mechanism had become so unreliable, as a precaution the majority of imaging programs were completed first with the mechanism fixed in place. Only later was the repaired mechanism actively used for spectroscopy.

3.3.2 Telescopes

Work on the Gemini South azimuth tape encoder heads was completed in October 2012. This significant effort brings into full operation a system that has not functioned properly in the past, and it may avoid a future purchase of new azimuth tapes.

A major escalation effort has been ongoing at Gemini North to solve a persistent vibration problem that began in early 2012 (soon but not immediately following the January shutdown). The effect has not been stable (both improving and getting worse) as instrument, cooling, and other arrangements on the telescope have changed; the work to resolve it continues.

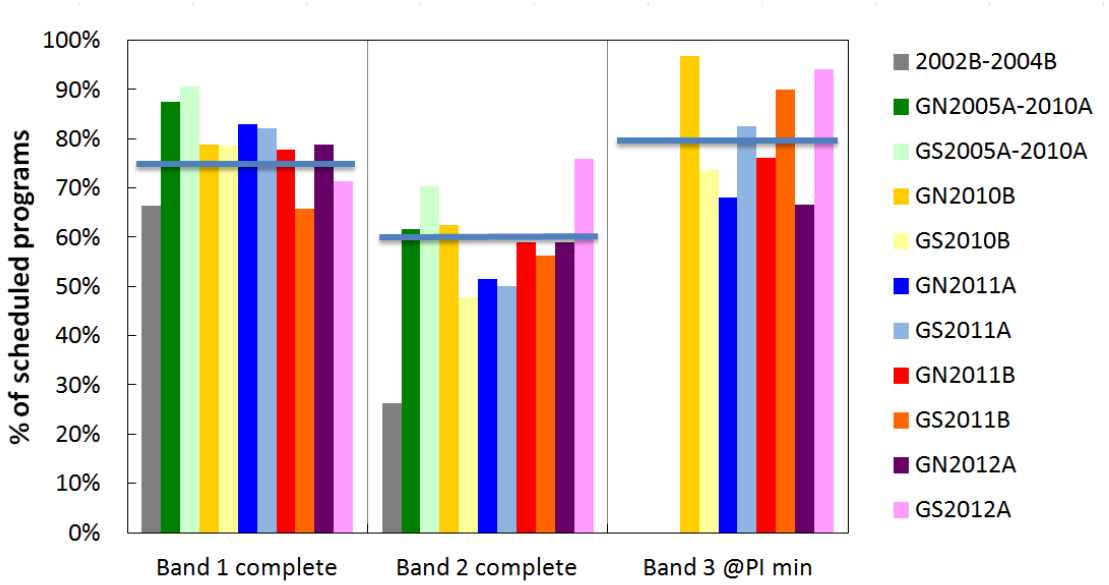

Figure 3-2: Completion statistics for GN and GS. Horizontal bars represent NSF target completion rates. Each group contains pairs of bars for north and south, and per semester; 2011B and 2012A are represented by red-orange and purple at the right of each group, with darker shades for the north and lighter shades for the south. The combination of more relaxed weather constraints and the timing of unexecuted commissioning blocks account for the high Bands 2 and 3 completion at GS in 2012A. Note that the Bands 1 and 2 targets are based on program *completion*, whereas the Band 3 target is based on each PI's *minimum* time requirement.

3.4 Operations Metrics

The statistics in this section refer to demand and performance in the last two complete semesters, 2011B and 2012A. The approved science programs, in both queue and classical modes, for these semesters are listed in Appendix D. Figure 3-2 shows queue completion rates per telescope for all semesters to 2012A. Note that 2012A programs may still be completed due to rollover status. Completion rates in Band 1 and (especially) Band 2 had been a cause for concern. These appear to have stabilized now, due in part to improved queue-filling algorithms. A second change that improves Band 2 completion is the reduction of rollover of incomplete Band 1 programs with tight observing constraints or at oversubscribed peaks in the RA distribution.

Semester	Site	Science	Engineering/ Commissioning	Fault loss	Weather loss	Shutdown
11B	North	59%	3%	4%	29%	4%
	South	54%	20%	3%	15%	9%
12A	North	64%	4%	4%	24%	4%
	South	58%	20%	3%	17%	1%

Table 3-4: Overall operational statistics, semesters 2011B and 2012A. Science time is distributed between Bands 1, 2 and 3 according to weather conditions and program priorities within the semester.

Tables 3-4 and 3-5 show top-level time distributions and science usage. The most significant difference between the North and South fault statistics is apparent in Table 3-5. In the South, the largest is “Telescope and Enclosure”. In the North, the largest single fault category is “Instruments and AO Facilities”, which mainly reflects the prevalence of faults relating to NIRI’s controller and Altair at Gemini North. Major telescope/enclosure faults are rare but are capable of losing significant time in a single instance. For example, in 2012A at Gemini South, more than one third of the fault loss in the “Telescope and Enclosure” category came from a single fault with the azimuth wrap, which lost a complete night. (Troubleshooting continued until midnight, and then the night was called off.) This was traced to a failed drive amplifier that was replaced the next day. In 2011B at Gemini South, two faults cost more than two hours. Gemini North suffered four faults greater than two hours in 2011B and two faults greater than two hours in 2012A. The

Semester	Category	North	South
11B	Computer/Software	9%	8%
	Instruments & AO Facilities	50%	33%
	Telescope and Enclosure	42%	59%
12A	Computer/Software	16%	16%
	Instruments & AO Facilities	48%	36%
	Telescope and Enclosure	35%	48%

Table 3-5: Categorized fault distribution, semesters 2012B and 2012A.

largest of these was the loss of 5.6 hours due to a failed altitude drive amplifier in 2011B, which was replaced the next night after extensive troubleshooting. During 2012 we have worked to upgrade our fault analysis to focus effort on the largest time-losers in each functional area.

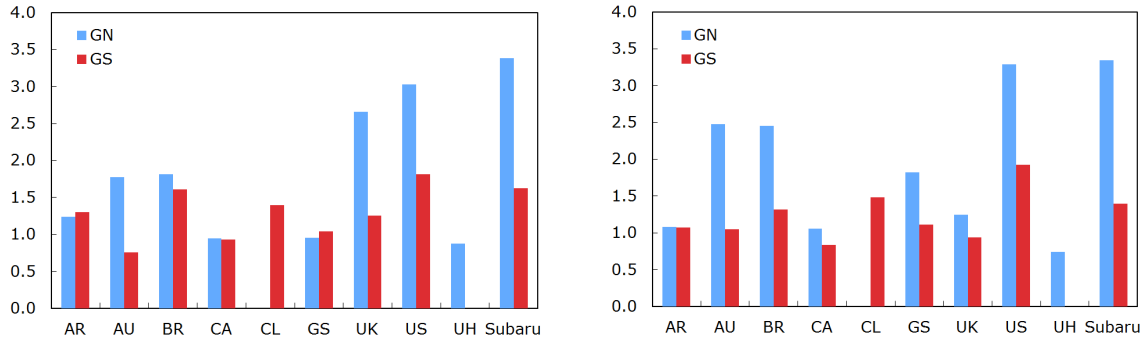

Figure 3-3: Oversubscription of Gemini North (GN, in blue) and Gemini South (GS, in red) for Semesters 2011B and 2012A, by partner, including Gemini Staff (GS) and Subaru exchange time.

The oversubscription rates of the telescopes by partner are shown in Figure 3-3. These rates are calculated as the ratio of the total time PIs request to the *total advertised available science time*, which assumes no weather loss though does account for planned engineering and commissioning work. There are two significant factors that reduce the actual time available for observing science programs. First, some time (typically a quarter) will be unusable due to weather loss. Second, standard calibrations are taken which PIs are not charged for and do not include in their requests, but which consume actual observing time. These calibrations vary by instrument, resulting in an effective 10% factor at Gemini North and 5% factor at Gemini South that is not part of the oversubscription rates shown. (The difference between the telescopes is a consequence of the different instruments used, with the infrared instruments generally having larger overheads for calibration.) In recognition of these effects, programs are approved to fill only 80% of the queue time available. Thus, the oversubscription rates shown underestimate the effective oversubscription rate (*i.e.,* a proposer's success rate) by a factor of about 35% (where the effective oversubscription rate is equal to the ratio of total time PIs request to total time allocated to PIs). This does not, of course, change the chance of obtaining data for a PI whose program is allocated time. The distribution of time requested by instrument is shown in Figure 3-4.

3.5 Safety

Gemini's overall safety perspective evolved from a local effort to a global perspective via a new safety management management system, called Hercules. This approach provides systematic hazards identification and risk control while maintaining assurance that risk controls are effective. In addition to core activities such as incident investigation and hazard identification, accomplishments of the Safety group in 2012 include development of a web-based safety training system and initiation of a safety-training database. Application of the latter when it is complete will target safety training to individuals' needs based on their job requirements.

The primary safety project for the Engineering Operations group in 2012 was the design, fabrication, and installation of safety access platforms for the enclosure shutters. This project mitigates the personnel safety risk while working on the shutter drive systems. An outside consulting architectural/engineering company worked closely with Gemini engineering personnel to satisfy the necessary design requirements and produced a set of bid drawings in 2012Q2. Gemini issued a request for proposals in May 2012 for the complete fabrication and installation of the safety platforms for Gemini North first to take advantage of the better northern summer weather for installation.

Two bids were received, with the low bidder at $265,000, which is about twice the projected cost. In order to reduce the cost of the safety platform project, Gemini will separately bid the fabrication and installation to enable local installation after remote fabrication. A request for proposals for the fabrication was sent out on November 8, 2012. Some 20 contractors expressed interest. The fabrication contract will be signed in December 2012, with receipt of goods in factory anticipated in early February 2013. The Gemini South safety access platform would be installed first, to take advantage of the better southern weather in March 2013. The Gemini North platform will be installed in the northern summer, later than May 2013.

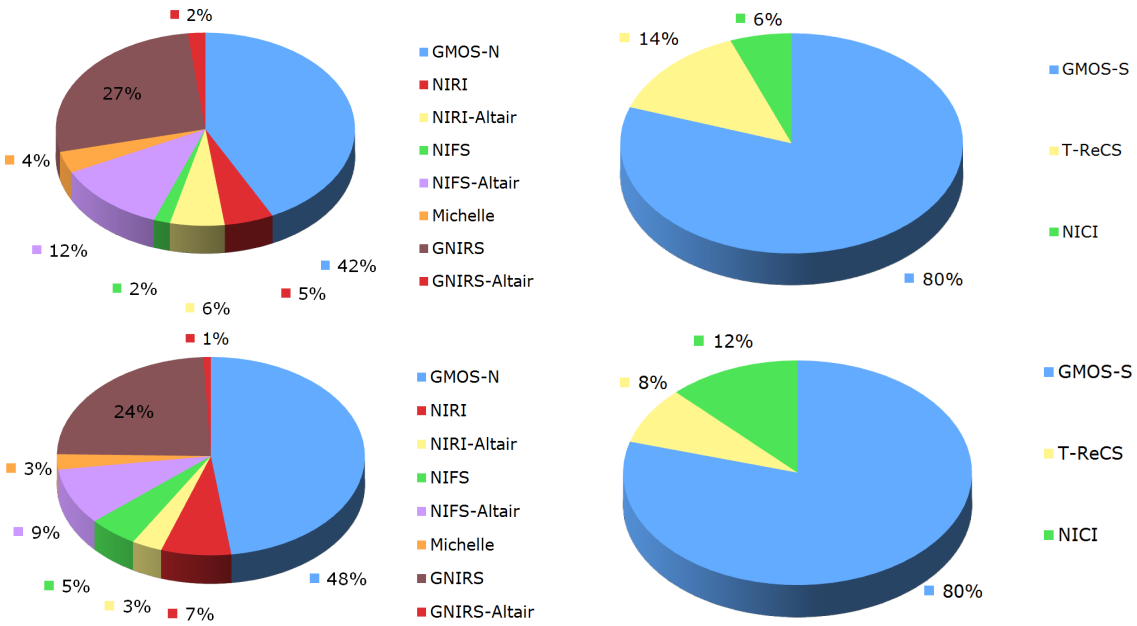

Figure 3-4: Requested time distribution across instruments in the north (left) and south (right) for Semesters 2011B (top) and 2012A (bottom).

4 Development

The Development Division has been extremely busy in 2012, with multiple challenging large projects. A presentation of the technical progress was made at the SPIE meeting in July (published in *Proc. SPIE* 8446, 844606). In addition to the specific work outlined below, a long-range plan is also being defined to project the instrumentation needed for the telescopes beyond 2015. The next capability to develop will be a workhorse instrument, likely providing efficient spectroscopy over a broad wavelength range. A call for proposals will be made toward the end of 2013 once the current suite of projects diminish or move to science operations.

The 2012 planned milestones within Development and their current status appear in Table 4-1. The progress on these projects is described in more detail below.

Project	**2012 scheduled milestones**	**Accomplished?**
FLAMINGOS-2	System Verification and start operations in Q2	No, delayed due to lens fracture
	Procure new lens and cell for L1 in Q3	Yes
	Improve the detector fanout board in Q2	Yes in Q3
	Run acceptance of all changes and install on telescope by end of the year	No, delayed until 2013Q1
GeMS/GSAOI	Complete technical commissioning in May	No, due to technical issues with GSAOI and poor weather in April-May
	Winter shutdown	Yes in Q2/3
	Improved sensitivity of NGSWFS	Not successful
	Technical and Science commissioning, System verification in Q4	Underway
GPI	Integrate all systems in Q1	Yes
	Run end-to-end characterization and measure contrast ratio in Q2	Yes
	Start Acceptance testing in Q3	No, delayed to 2013Q1 due to deformable mirror actuator failure
GMOS-CCD	Improve noise performance in Q2	Yes in Q3
	Finish lab work in Q3	Underway in Q4
GRACES	Purchase and test small fiber by Q3	Yes
	Long fibers tested by Q4	No, delayed until 2013Q1 due to technical issues
	Design and purchase injection and coupling components by Q3	No, delayed into Q4
	Write control software in Q2/3	Yes
	Components ready to ship to MK in Q4	No, delayed to 2013Q1
GHOS	Conceptual Design Review in Q3	Yes
	Construction contract signed in Q4	Underway
	Kickoff meeting for preliminary design in Q4	No, delayed to 2013Q1
A&G-2	Finish conceptual studies for dichroic and GCAL in Q2	Yes
	Prepare Request for Proposal by Q4	No, postponed to 2013 because we undertook a feasibility study to adjust the scope to the budget
Adaptive Optics	Implement LGS+P1 hardware in Q1	Yes
	Commission with instruments by Q4	Yes
	Organize AO workshop and produce report by	Yes

	Q4	
Base facility operations	Collect all requirements in Q1	Yes in Q2
	Conceptual design Review in Q3	No, delayed to 2013Q1

Table 4-1: 2012 plan and accomplishments for Development.

4.1 FLAMINGOS-2

This new instrument underwent technical and science commissioning on the telescope in January 2012, and the first multi-object spectra were acquired. In early February, we discovered a catastrophic fracture of the main large collimator lens L1 (made of CaF2, 260mm diameter; Figure 4-1). This lens is part of the Multi-Object Spectroscopy (MOS) dewar that is regularly exposed to thermal cycles in order to exchange the slit masks. An escalation activity was immediately launched including external reviewers from our community, and the report issued in April resulted in the following corrective actions:

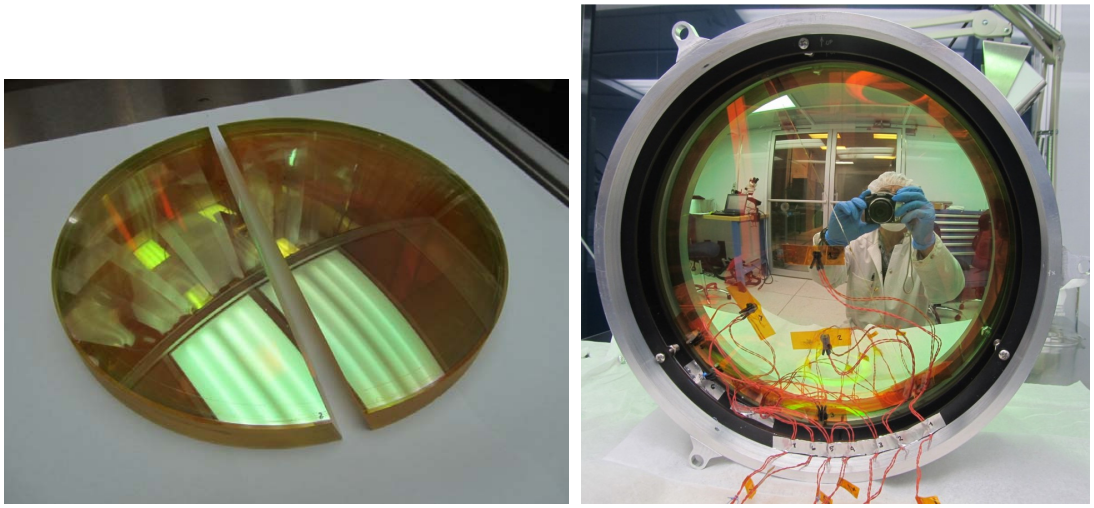

Figure 4-1: Fractured CaF2 collimator lens (left) and thermal experiments with sensors *in situ* (right).

- Procure a new lens and spares with improved specifications to increase material strength.
- Redesign and rebuild the cell to decrease the mechanical stress with improved support pads. The design was supported by finite element analysis and a thermal model done by en external contractor, allowing us to predict the behavior of the new mounting arrangement.
- After inspection of the camera dewar showed some stress on other lenses, we decided to retrofit some minimum improvements to all these other eight cells and replace some stressed lenses as a precaution.
- The broken lens was used to test the new cell *in situ* and thermal cycles were conducted to calibrate the model and gain confidence for the new L1 lens.

In parallel to the opto-mechanical activity, we implemented a significant improvement to the detector fanout board in order to improve thermal stability and reduce the known delamination risk. This entire instrument repair process was estimated to take between 9 and 12 months. As of November, we are proceeding with final integration and re-alignment and expect the overall instrument shutdown to have a total duration of 12 to 13 months.

4.2 GeMS/GSAOI

The Gemini Multi-conjugate adaptive optics System (GeMS) is currently used with the Gemini South Adaptive Optics Imager (GSAOI) as the science instrument. Phase 6 of the project (through May) continued the technical and science commissioning. Challenges included poor weather and the unavailability of GSAOI for one observing run (because of condensation on the entrance window). Instead, GeMS was briefly tested with GMOS in visible light, yielding some spectacular results (typically FWHM of about 0.2" or better; Figure 4-2) confirming this facility's uniqueness and exceptional potential.

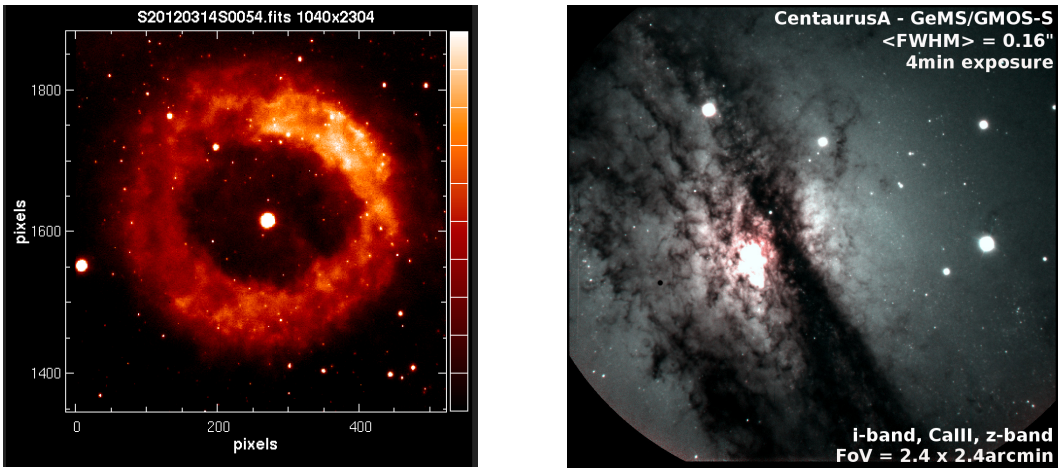

Figure 4-2: (left) NGC6369 with GeMS and GMOS, *I* band, 10 minutes exposure, FWHM is 80milliarcseconds, field is 18x18". (right) Centaurus A.

Phase 7 started in June during a southern winter shutdown dedicated to various improvements to increase the reliability and smoothness of operations. The performance with the natural guide star wavefront sensor (NGSWFS), the subsystem that is used to acquire the guide stars correcting in the visible for tip-tilt and plate scale modes, continues to be an issue. It is currently limited to acquiring stars brighter than *R* magnitude 15.5. Attempts to improve alignment and coupling into optical fibers and avalanche photodiodes were not successful, and a new strategy will be defined in early 2013 to make further upgrades later.

In terms of reliability, several subsystems related to laser operations and beam transfer optics were improved (namely alignment, remote focus mechanism for the laser launch telescope, diagnostics, and safe remote control of laser). Cross-training of employees continued, in order to have a larger base of staff able to support the system. Several weaknesses of GSAOI were also corrected, such as decoupling the component controller reboot from the cryo-heads' operation, to allow for greater thermal stability of the instrument.

Phase 7 did not complete all the planned work packages: some documentation is still ongoing; laser internal alignment is continuously being reviewed for improvement; and amplifying waveguide spares are being procured. Nonetheless, both Canopus (the AO bench) and GSAOI were installed on the Gemini South telescope in October to resume commissioning and system verification. One run (typically a week) is scheduled every month around full moon into 2013. GeMS was offered in shared risk mode for 2013A, when we expect to start early science operations, although it will likely take at least a year to continue stabilizing, simplifying, training night staff, and improving efficiency of

operations for this complex observational system. We have established a detailed set of key performance indicators to monitor various aspects of the operations during technical commissioning in order to establish a baseline, fix some targets, and then thoroughly monitor our progress.

4.3 Gemini Planet Imager

The Gemini Planet Imager (GPI) is at the University of California Santa Cruz undergoing final integration and testing after all systems (including the science instrument) were received and successfully integrated. In April, end-to-end measurements were made to determine basic performance and to test various techniques to meet the very high contrast ratio desired (10^{-7} at 0.5" from the observed star). See Figure 4-3 for a lower-performance example from initial testing. Polarimetric speckle suppression has already produced spectacular results with contrast ratio of 1.5×10^{-7} at 0.4". A deformable mirror actuator failure (in June) and some other issues encountered during testing introduced a schedule delay of about three months and led to a period of remediation (including developing a new Lyot mask to hide the failed actuator and minimize its impact on performance). As of November, this remedial work is being completed, and the science instrument is undergoing a new cooldown cycle. System performance will be measured again, and a pre-acceptance review is planned before the end of the year.

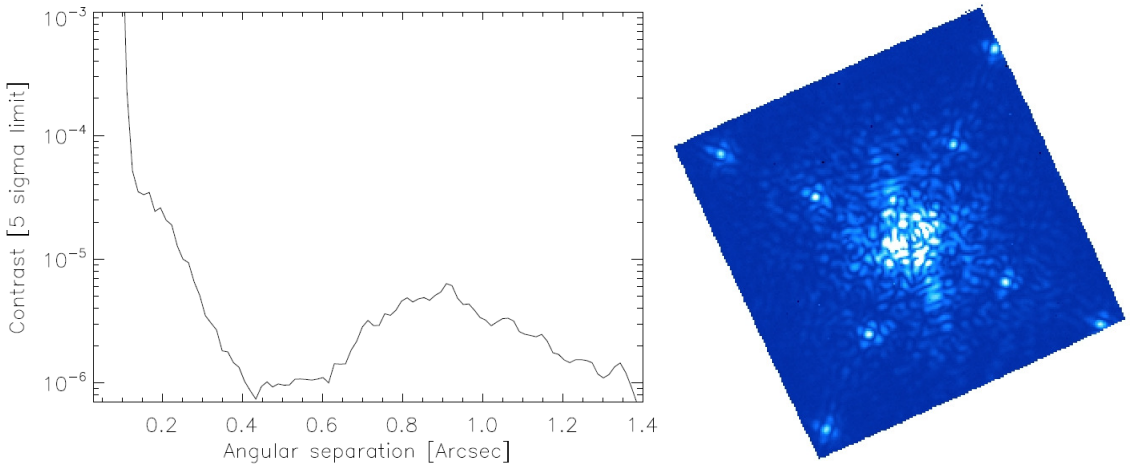

Figure 4-3: Contrast ratio (left) and corresponding image (right) from GPI in May 2012.

4.4 GMOS CCD Upgrade

The new deep depletion E2V CCDs that were installed in GMOS-N in the end of 2011 are performing well. The fully depleted Hamamatsu CCD upgrade work continues, and the first set of detectors is expected to be ready for installation by the end of 2012. The team at the Herzberg Institute of Astrophysics (HIA in Victoria, Canada) designed and built the Hamamatsu upgrade hardware, software, and electronics and delivered them to Gemini in late 2011. Since arrival at Gemini, we have reduced the read noise in the system and installed a replacement CCD for one that was damaged earlier. We are now characterizing the new detector. The next steps will be to align the final three-CCD array and optimize the overall performance in the offered modes.

Having to replace one science CCD has allowed us to take advantage of ongoing coating improvements at Hamamatsu. The new CCD has better blue response than the other two, essentially matching that of the current GMOS-S CCDs. As such, this CCD

will be mounted in the blue-most spectroscopic position. Its red response remains the same as the other two CCDs in the array. Quantum efficiency approaches 90% at 900nm and 40% at 1micron.

Figure 4-4 shows the quantum efficiency versus wavelength for the three types of CCDs used, as well as their respective location in the focal plane array. The dark circle represents the unvignetted field of view of GMOS.

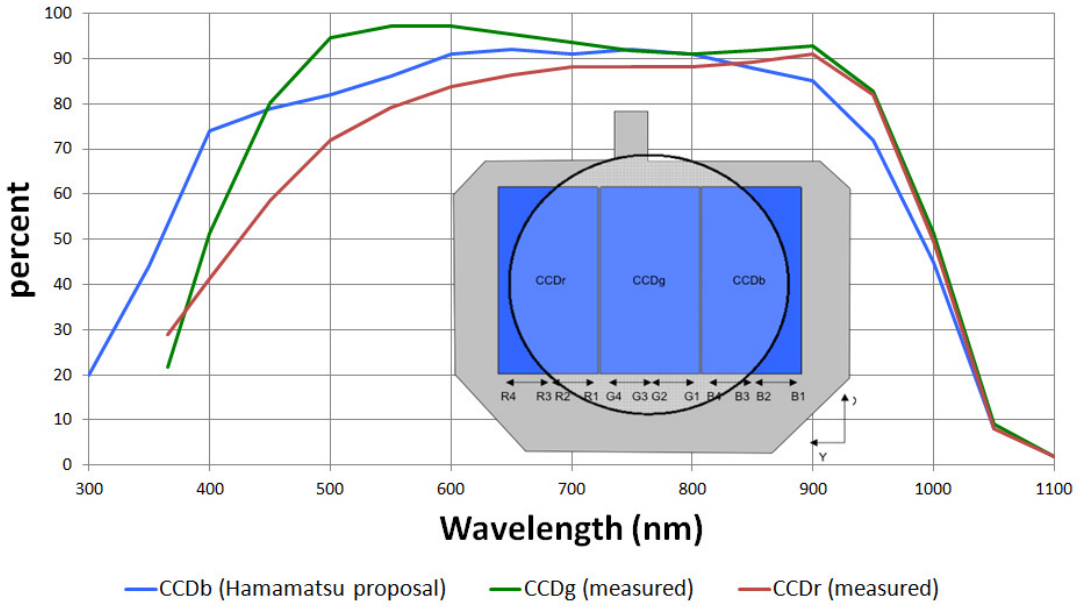

Figure 4-4: Hamamatsu CCD quantum efficiency.

The installation schedule must accommodate telescope shutdown periods and the allocation of internal resources to other observatory projects. We are now planning to install the current Hamamatsu detector array into GMOS-S starting in June 2013, provided that other instruments are available to use the telescope effectively. This schedule includes several months of contingency but could be delayed if FLAMINGOS-2 and GSAOI are themselves delayed. Assuming the GMOS-S installation is successful, we will purchase the components necessary for the GMOS-N upgrade and work to install them sometime in 2014.

4.5 GRACES

The Gemini Remote Access to the Canada-France-Hawaii Telescope (CFHT) ESPaDOnS Spectrograph (GRACES) began full-scale development of Phase I, which will now go into 2013. A contract was signed with CFHT (and the subsequent sub-contract with HIA) in December 2011. Phase I is the experimental phase of the project with the primary goal of successfully fabricating a 270-meter long optical fiber cable assembly that maintains delivered throughput. Major activities in Phase I are: 1) fabrication of up to three optical fiber cables; 2) design and fabrication of a new image slicer and associated opto-mechanical hardware for the injector portion of ESPaDOnS; 3) design and fabrication of the opto-mechanical input hardware for the optical fiber (which will be located in a filter cassette in GMOS-N); 4) provide GRACES control and data reduction software; and 5) commission on sky and conduct early science observations.

The optical fiber cable assembly will use two Polymicro Technology 165 µm low loss broadband optical fibers in an armored cable. HIA has been testing these fibers to determine if we can achieve the required performance, especially focal ratio degradation (*i.e.*, fiber output 'beam broadening' results in light loss to the spectrograph). Although short sections (up to 36 meters) produced good results, the 270-meter length did not. The fabrication of the fiber cable was outsourced to a commercial vendor who has experience with other scientific fiber-fed instruments. The quality of the fiber link is critical to the performance of GRACEs and could cancel the project if not meeting specifications. If validated, the cable will be integrated and tested with the input and injector hardware before being delivered to Mauna Kea (now planned for 2013Q1).

Meanwhile, Gemini completed version 1 of the GRACES control software in August, and CFHT is nearly finished with developing their new generation of data reduction software for ESPaDOnS, called OPERA. OPERA is currently undergoing testing with CFHT/ESPaDOnS data and will be available to GRACES users. The opto-mechanical design of both the input and injector hardware is in the critical design phase and is being sent out for fabrication in 2012Q4. Purchase orders for the major optical systems, including the new image slicer, were placed with vendors and all components are expected in January 2013.

4.6 GHOS

Three teams, led by the Australian Astronomical Observatory, University of Colorado, and the Herzberg Institute of Astrophysics, completed conceptual designs for Gemini's next facility instrument, the Gemini High-resolution Optical Spectrograph (GHOS). The baseline requirements for GHOS were for a single-object, R~40,000, spectrograph with simultaneous coverage in the range of 370–1000nm. Multiple object and spectropolarimetric capabilities were listed as desired enhancements. The goal is to have an instrument available to Gemini users in 2016.

The conceptual design review was held in June and, in August, the Gemini Board authorized continuation to negotiate the necessary future work with the winner of the down-select. As of November 2012, the negotiations are continuing and the selected team will be announced once an agreement has been reached. At that point, the project will resume with a preliminary design phase kickoff meeting (around mid-January 2013) and we will have a more concrete set of instrument parameters and schedule to discuss with the community.

4.7 Acquisition & Guiding Units

A project to redesign and build two new acquisition and guiding (A&G) units was initiated around 2006 when the reliability of these units was causing significant down-time due to faults and shutdowns for maintenance. In addition to the large amount of time required for repair and maintenance, recent additional motivation for considering upgrades are the low sensitivity of the wavefront sensors (impacting sky coverage) and the fact that the systems do not allow for future expansion.

At the beginning of 2012, we concluded two small feasibility studies with external contractors to review the possibility of adapting a science dichroic in lieu of the science fold mirror directing the light to the various instruments, and the possibility of moving the calibration unit (GCAL) from a science port into the A&G in order to free up space for an additional instrument.

In 2012Q3, we significantly redesigned the project due to three factors: 1) time loss has decreased by a factor of two over the last six years, and is currently down to one night lost to faults and eight nights for maintenance (per site and per year); 2) the existing budget ($4M) is a severe cost constraint for such a complex assembly; and 3) the original project business case reveals an unattractively long return over investment period. We therefore launched an internal feasibility study to cost various options. More than ten options were reviewed, covering a broad range from two new A&G units with GCAL repackaged to less ambitious upgrades. We ranked the options using various merit functions, supported by detailed cost analysis and value measurements of weighted criteria. The options that we will pursue for detailed feasibility studies are: 1) an upgrade to Module 4 to boost the sensitivity of the peripheral wavefront sensor and allow both fast tip-tilt and active optics in closed loop; and 2) overall reliability upgrades guided by the failure mode analysis.

4.8 Gemini North Adaptive Optics Development

We have focused new work in adaptive optics (AO) development in two main areas during 2012 that specifically address AO at Gemini North.

Gemini North Laser Guide Star + Peripheral WaveFront Sensor 1 (LGS+P1)

The project goal was to increase the laser adaptive optics sky coverage to nearly 100% using a natural guide star at 4–7 arcmin separation along with the laser guide star. The resulting performance is essentially a “super seeing” mode, with delivered full width half-maximum of objects typically half of the natural seeing. This mode is very attractive for spectroscopic work in particular, opening virtually the entire sky to NIFS with AO, for example. On-sky commissioning with NIFS and NIRI was completed. This mode has been available to the science community as shared risk since 2012B, and it will be fully supported in 2013A, likely occupying about 40% of LGS usage.[1]

AO workshop

Gemini led a Gemini North adaptive optics (GNAO) science workshop at HIA on June 19-21, 2012. The workshop was organized around Astro2010 “New Worlds, New Horizons” science topics and had broad participation from the international community. The participants developed a total of 63 different potential science cases. The workshop concluded that, at present, a small field, high Strehl GNAO facility with high sky coverage would enable the most science and thus was assigned highest priority. However, in addition, there were many other science cases identified which would take advantage of multi-conjugate AO (MCAO), an extreme AO system, or a ground layer AO facility. The clearest conclusion was that most areas of science would benefit from the Gemini North telescope having an adaptive secondary mirror (ASM). The process and outputs of the GNAO workshop were summarized and presented at the Gemini User Meeting in July 2012.

Given the outcomes of the science workshop, as well as the guidance from the STAC and Board to keep AO as an important capability for Gemini North, we are considering several options going forward: building a next-generation Altair (refurbishing or replacing the existing single-conjugate AO System, without an ASM); building an MCAO system (replicating MCAO from Gemini South); building an ASM GNAO system (a modular approach starting with an ASM); and starting inter-observatory collaboration (ground-

[1] http://www.gemini.edu/sciops/instruments/altair/lgs-p1-quotsuper-seeingquot-mode

layer AO with Subaru, CFHT, or Keck collaboration). Gemini will continue exploring those options in 2013 to refine estimates for funding and resources.

4.9 Base Facility Operations

The base facility operations project, to enable routine operation of the telescopes and observing from the base facilities without staff on the summits at night, is now in progress. The project started with identification of fundamental requirements as well as opportunities to improve reliability. The project team is now gathering information on the current observatory operating processes, refining the requirements in each of the defined areas, documenting the existing systems and issues that need to be addressed for base facility operations, identifying conceptual design solutions, and estimating the resources required to implement them.

The conceptual design review is planned for April 2013. The operational concept, observing scenarios, and the resulting requirements will be presented. Requirements will be identified for operational considerations, software infrastructure, audio/video monitoring, environmental monitoring, and monitoring and control of all telescope, enclosure, support facilities, instruments, and laser systems. High-level design alternatives, interface definitions, and resource requirements will be presented to enable decisions on scope, schedule, and costs. The expected outcome of the Conceptual Design Review is agreement by all parties on the requirements, the proposed solution, what the project will deliver, as well as the resources needed to achieve our goals.

With a solid architecture established in the conceptual phase, work can continue on each component subsystem individually. If a subsystem is simple and there is a clear design solution the team will proceed directly to detailed design. If more than one viable design alternative is identified, or the subsystem is complex enough to warrant it, a preliminary design phase and review will be undertaken prior to developing a detailed design. After a detailed design review, implementation will follow as soon as possible, at both sites whenever feasible. This approach allows progress on each area as resources are available, and the incremental implementation allows users tointegrate new capabilities into operations one at a time.

To see base facility operations in action, the team visited CFHT and the United Kingdom Infrared Telescope. The Gemini project will certainly benefit from their lessons learned and best practices.

5 Public Outreach and Broadening Participation

5.1 Public Information and Outreach

During 2012 the Public Information and Outreach (PIO) effort responded to the changing priorities at Gemini Observatory. Central to the PIO department's new priorities is effective communication with our user communities and the use of new and social media to disseminate our work. Balanced with this is the continuation of most key programs, initiatives, and products such as local outreach programming, media relations, library operations, and print and electronic media production. Most of these programs have been streamlined with increased parity between North and South sites to realize economies of scale and increase efficiencies to accommodate new user communication efforts. The following summarizes these activities and accomplishments.

5.1.1 Primary Outreach Programming

Hawaii's *Journey Through the Universe* and Chile's *Viaje al Universo*

Gemini's two annual flagship outreach programs, *Journey Through the Universe* and *Viaje al Universo* each had record attendance in 2012 and good participation by Gemini and other local observatory staff. These programs immerse observatory staff for a week in local schools and community events. The programs (held in March in Hawai'i and August in Chile) attracted over 20,000 participants (see data in Table 5-1) and engaged local businesses, educational institutions, and local governments and officials. In the 10th year in Hawai'i and 3rd in Chile, this program continues to grow each year both in impact and reach.

Figure 5-1: A Chilean family works together to make a scale model of the solar system out of clay as part of the *Viaje al Universo* program n 2012.

StarLab Planetarium

In Gemini's host communities in Hawai'i and Chile, the StarLab program continues to directly engage local students and educators with classroom presentations and additional resources. In Chile, this program provides interactive presentations to students with content ranging from recent Gemini findings to the economic and environmental impact of light pollution. In Hawai'i, the program focuses on a training program that certifies teachers to borrow and operate the StarLab portable planetarium for integration into classroom curriculum in astronomy and

Activity/Event	Participants
Journey Though the Universe – Hawai'i	11,370
Viaje al Universo - Chile	9,321
StarLab (Hawai'i and Chile)	4,889
Other Public Events	6,731
Live from Gemini (Hawai'i)	131
Summit Tours (Hawai'i and Chile)	763
Total	**33,205**

Table 5-1: Outreach participation.

Polynesian navigation. In total, the StarLab program reached over 4,600 students and teachers in the past 12 months, and demand remains strong for this ongoing program.

Live from Gemini

Utilizing the latest videoconferencing technology, the *Live From Gemini* program brings students from across the Gemini partnership into the Observatory control room for a real-time experience in how science is done. Hosted by Gemini PIO staff, over 100 students and educators from Australia and the mainland US "visited" the Gemini North control room in 2012 (Table 5-1). Highlights from this year include the participation of several classes that joined in the Australian National Gemini Office-sponsored student imaging contest. This program is offered to the entire Gemini partnership, and all requests were fulfilled in 2012.

5.1.2 Public Information and New/Social Media

Press releases

During 2012, Gemini PIO developed and distributed 10 press releases on topics ranging from Gemini's next generation adaptive optics system (GeMS) to the sharpest-ever ground-based optical images of Pluto and its moon Charon. Collectively these releases garnered over 54,000 unique web-hits on the Gemini website and were featured in media venues such as Discover Magazine, Time, Space.com, and the BBC. (More media coverage is listed at http://geminipio.blogspot.com/.)

WebFeatures

A diverse collection of Gemini science results were also featured in 13 "WebFeatures" in 2012. Targeted at the scientific community, these stories netted almost 26,000 unique web-hits and covered stories on multi-tasking supernovae, quenching star formation in redshift one galaxies, and unprecedented precision in standard candles for cosmology. A full list of these stories and press releases is at http://www.gemini.edu/sciops/releases.

Social Media

Gemini's growth in the social media realm advanced considerably in 2012. Figure 5-2 shows this continued growth in Facebook impact as measured by post views and "likes." (We grew by over 1,000 "friends" in 2012). To support this effort, PIO staff help to identify and produce content for regular posts of observatory activities. In addition, Gemini staff from all departments are engaged in these efforts, increasing visibility in social media. Two PIO staff also participated in conferences in social and new media during 2012, resulting in many new ideas and approaches, such as social media events, contests, increased staff postings (to increase the variety of "voices"), and shorter, more dynamic videos to better engage our social media followers.

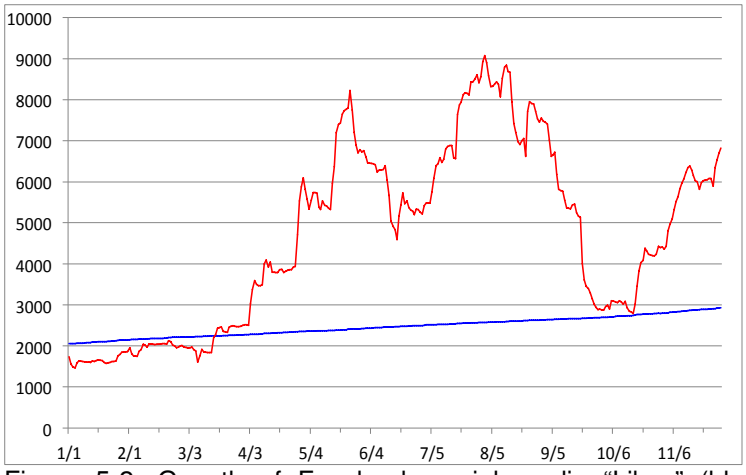

Figure 5-2: Growth of Facebook social media "Likes" (blue) relative to the number of people seeing Gemini's posts in continuous 28-day samplings (red).

GeminiFocus Electronic Transition

The twice-annual Gemini newsletter, Gemini*Focus*, underwent a transformation in 2012. With the June issue, a hybrid approach was adopted in which a three-page table of contents hard-copy was produced with all other content online and downloadable via the Gemini website. It is envisioned that the December issue will follow this trend with a small number of full-edition hard copies produced in early 2013 for distribution to libraries and funding agencies for public display or use. The transition saves significant resources in printing and distribution costs, and it provides more current content in the publication.

5.1.3 Strategic Communications

A significant effort began in 2012 with the goal of improving Gemini's communications with our scientific user community. The PIO department is implementing a comprehensive plan that leverages the department's existing resources and helps the observatory's scientific and technical staff communicate the information they possess. Upcoming events are now registered in an online, multi-user spreadsheet, with standard protocols and procedures for each event and defined category. A calendar shows the planned frequency of regular communications, including press releases, website features, newsletters, social media, and email distribution. The email lists themselves will be reviewed for better focus and audience targeting. These tools and resources are already being used, and in 2013 they will become a regular part of ongoing operations. The improved structure and advance planning help to streamline existing communications functions and offset the increase in effort of these new functions. Additional effort, including contracted services, will be redistributed, taking advantage especially of efficiency gains from running common programs North and South and increasing electronic dissemination of communication products. Furthermore, the future structure involves additional groups in tasks such as content review and the identification of key events and milestones, without significantly increasing non-PIO staff responsibilities.

5.2 Broadening Participation and Workforce Development

Several activities to develop the workforce pipeline have advanced during 2012. Gemini has been a key contributor to The Hawaii Island Workforce initiative, which is a strategic project to position the local environment to meet future workforce needs. We have developed stronger, more proactive relationships with the University of Hawai‘i through this initiative.

In 2012 we improved recruitment processes and practices. Training will be provided to all staff on best practices, including the implications of and mitigations for unconscious bias. We have made specific progress to hire and promote female engineers. Since 2010, the number of female engineers at Gemini has increased from 4 to 6, including Gemini's second female Chilean engineer.

There has been continued investment in internship programs (Table 5-2) with partner countries and Hawai‘i/Chile-based initiatives. 113 Interns have worked at Gemini since 2006, 17 of these during 2012. The mentoring program is developing further and there are currently over 20 mentoring relationships in place.

Department/ Specialty	**Funding By**	**Educational Skill Level**	**Intern Program**	**2012** interns
Engineering/ Technical / Science	Akamai	Undergraduate	Akamai	3
Engineering /Technical	Gemini	Undergraduate/Graduate	Univ. of Victoria	3
Science	AGUSS	Undergraduate	AGUSS	…
Science	Fisk Vanderbilt	Undergraduate/ Graduate	Fisk Vanderbilt	…
Science/ Other	Gemini/Unpaid	Undergraduate	Univ. of Hawaii	1
Engineering/ Technical/Admin./Science	Unpaid	High School	Huiana	1
Miscellaneous	Gemini/Unpaid	Various	Internal	3
Engineering	AURA/Gemini	Undergraduate/Graduate	Chilean Universities	6

Table 5-2: Intern programs and participation.

6 Organization and Budget

6.1 Management and Organization

The Gemini Directorate went through significant changes during 2012. Fred Chaffee concluded his term as Interim Director in May 2012, and Nancy Levenson served as Interim Director from then through July 2012. The search for a new permanent Director was concluded during the year, and Markus Kissler-Patig was appointed Gemini Director effective August 2, 2012. Diego Correa began his term in the new position of Chief Financial Officer in January 2012.

Another significant organizational change was the transfer of administrative functions such as accounting, procurement, shipping and receiving, and human resources to consolidated AURA management. Effective October 1, 2012, Gemini staff no longer provide these services. AURA's Centralized Administrative Services (CAS) now supports accounting and procurement. Human resources is separately organized under AURA. The staff in these consolidated groups are located in Hilo, La Serena, and Tucson.

The restructuring to accommodate CAS occupied much of the effort of Gemini's Administrative group during 2012. The team's main accomplishments during the year were:

- Transferring Accounting, Payroll, Procurement, and Shipping and Receiving services to AURA's Centralized Administrative Services (CAS);
- Implementing a new account structure that allows CAS to consolidate financial information for all AURA Centers; and
- Implementing labor and budget input models for the financial planning and reporting system Control, which allows users to accurately produce financial plans that include cost of labor resources and report detailed budget input components and values.

The organizational structure of Gemini reflects the philosophy of "one observatory, two telescopes." Senior staff are divided between the sites, and managers of groups that are organized according to function, especially in Engineering and Administration, lead teams that are located in both Hawai'i and Chile. The personnel are further matrixed, with many having duties in both operations and development projects. With the expectation that the major in-house development projects will conclude soon, the reporting lines are aligned according to functional area within Operations, the largest division at Gemini. A small number of people whose major activity is dedicated to instrument and facility development are part of the Development division, in addition to the entire AO team and the systems engineering group, both of which participate in operations and development activities. Appendix E shows the Observatory's complete organizational chart as of the end of 2012.

6.1.1 Staffing Challenges

The withdrawal of the UK from the Gemini partnership in 2012 and the current economic circumstances have brought unprecedented challenges to the management of the Observatory. Our future goal is to have a competitive and financially sustainable Observatory with a highly motivated staff. A critical element of that goal is to develop a Gemini staff retention plan. So far we have identified key contributors and high potential

staff, developing a specific action plan for each. We have also focused on the following broad areas:

- Compensation and benefits;
- Employee communications;
- Morale, motivation and engagement programs such as:
  - Continued investment in training and development for employees and managers;
  - Gemini mentoring program;
  - Management of retention risk;
  - Review of staff turnover and analysis of reasons for leaving.

DEPARTMENT	2012	2013
ADMINISTRATION[1]	40.8	31.3
INSTR. DEVELOPMENT[2]	12.9	12.2
ENGINEERING	80.0	78.0
SCIENCE	59.2	55.2
Total (A)	**192.9**	**176.6**
VARIATION Y2Y		-16.3
CAS (B)	2.8	10.0
GRAND TOTAL (A+B)	195.7	186.6

Table 6-1: Staffing plan in full-time equivalent (FTE), per department. Operations and development funds together support this full staff complement.
Notes:
[1]including Safety and Public Information and Outreach
[2]including Adaptive Optics and Systems Engineering

6.1.2 Staffing plan for the years 2012 and 2013

Table 6-1 presents Gemini's revised staffing level for the years 2012 and 2013, which is based on the assumption that these resources will provide: queue and classical observing support; operations and maintenance of two 8-meter class telescopes with sophisticated laser adaptive optics systems; data storage and reduction capability that provides data to the user and the Gemini Science Archive; a public information and outreach program; a safety team; and a facilities and infrastructure team that supports all observatory activities.

6.1.3 Advisory and Oversight Bodies

Governance of Gemini Observatory is described in the International Agreement among the partner funding agencies. The needs and interests of each partner are represented through a number of different channels, described here.

The *Gemini Board* serves as the supervisory and regulatory body, setting budgetary policy bounds and carrying out broad oversight functions. The *Gemini Finance Committee* acts as a subcommittee of the Board. It is comprised of financial authorities from the partner countries and advises the Gemini Board on financial plans and budget.

The Gemini *Science and Technology Advisory Committee (STAC)* advises the Gemini Board on policy matters of long-range scientific and technical importance, to enhance the long-term scientific productivity of the observatory. This committee provides advice on scientific priorities for new instrumentation and other projects to maintain or improve the facility, and they keep the Board informed of the scientific priorities of the partner communities. The Observatory and STAC work closely together to identify the long-range issues that require attention. The STAC is also charged to define an Instrument Science Team for each new instrument project to ensure a good connection between the desires of the Gemini user community and the delivered performance.

The *Users' Committee for Gemini Observatory (UCG)* provides feedback to the Observatory on all areas of its operations that affect current users of the facility. The committee members base their input on their own experience and information they solicit from the broader user community. Gemini uses this feedback to improve the service it provides to users.

The operational model for the Gemini Observatory delegates many functions to the partners. Each partner has a *National Gemini Office (NGO)* that provides the local interface between the national community and the Gemini Observatory to support their users. Among the many responsibilities, each NGO supports the evaluation of proposals for national or site time through a national time allocation committee, including providing for technical review and recommendation for time allocation to the international time allocation committee. The NGOs support users who have been allocated time during the Phase II process, and they directly provide technical support of instruments and systems throughout the year. The NGOs also promote Gemini capabilities and use within their national communities.

The *Operations Working Group* advises the Gemini Director on the use and scheduling of the Gemini telescopes, and on matters related to the user support interface between the national communities and the Observatory. The group reviews science operations and makes recommendations for improvements, recommends content for each semester's call for proposals, and collaborates on science operations support among the NGOs.

6.2 2012 Budget

6.2.1 Partner Contributions

2012 actual contributions from Gemini's partner countries consist of the US component included in NSF's FY12 Astronomical Sciences budget plus non-US partner contributions. Partner countries operate on different fiscal years, and funding agencies forward their payments in different forms and on different schedules to Gemini's Executive Agency, the NSF. Table 6-2 shows Partners' 2012 total intended contributions to Gemini's Operations and Instrumentation funds.

Partner	Intended Contribution
US	21,569,241
UK	7,382,762
Canada	5,623,710
Australia	2,364,799
Argentina	1,058,297
Brazil	908,142
Total	**38,906,951**

Table 6-2: 2012 intended contributions

6.2.2 Expenditures by Fund

The Gemini budget recognizes three distinct expenditure categories: Operations and Maintenance (O&M); Development, supported by two funds, the Instrument Development Fund (IDF) and the Facilities Development Fund (FDF); and Facilities (for capital facility upgrades, not operating expenses). Table 6-3 gives the summary of 2012 year-end expenditures in terms of the funding sources. Among the facilities funds, only the Southern Base Facilities Fund (SBF) is relevant in 2012. In addition, we list the special grants and award funds (SPEC), by which the NSF and NASA support individual investigators.

2012 year-end expenses for O&M are smaller than the 2012 budget approved by the Board. Part of this unspent budget is the result of a deliberate effort from Gemini's Management to decrease O&M expenditures, by actively reducing spending in discretionary expenses such as travel, supplies and equipment. Spares and capital equipment were also underspent in 2012, a consequence of shifting planned activities to 2013. Decreasing 2012 O&M expenses drives an increasing balance of unspent contributions and creates availability of Operations resources to smooth the transition from the current partnership to the withdrawal of the UK at the end of 2012.

The IDF 2012 actual expenditures are also smaller than the 2012 budget. Most of the IDF budget (a minimum of 85%) consists of contracts to external vendors. The variance is due to contract payments postponed until 2013 because of concurrent delays in design, experimentation and completion activities for the instrumentation projects FLAMINGOS-2, GeMS, and GRACES. IDF contract payments in the amount of $1.9M have been rescheduled and will be executed in 2013 subject to the completion of project deliverables.

In $1000	**2012 Budget**	**2012 Actual**					**2012 Commit.**	**2012 Actual Exp**	**2012 Actual and Commit. vs. Budget**	
		Q1	Q2	Q3	Q4	FY12	Dec 31	Dec 31	$	%
O&M	30,362	6,761	6,800	6,355	7,424	27,339	2,140	29,479	(883)	-7%
IDF	8,413	918	1,055	1,214	733	3,921	2,588	6,509	(1,904)	-34%
FDF	1,505	235	210	186	184	816	333	1,149	(357)	-18%
SBF	44	72	0	4	0	76	-	76	33	75%
SPEC	50	27	22	34	13	95	1	97	47	91%
Totals	40,374	8,013	8,088	7,793	8,353	32,247	5,063	37,310	(3,065)	-8%

Table 6-3. 2012 budget and actual expenditures, by fund.

The largest active project of the Facilities Development Fund (FDF) is the Multi-Conjugate Adaptive Optics (MCAO) system. FDF's 2012 expenditures and encumbrances value of $1.1M includes MCAO expenses of $776k and Laser Service contract payments of $228k. A&G system development budget for 2012 was significantly reduced from $883k to $143k; the $740k unspent budget will be allocated to the FDF 2013–2016 budget.

7 Program Plan for 2013 and Beyond

7.1 Plan through 2016

The goal of the Gemini "Transition Plan" is to develop sustainable operations at a reduced budget by 2016, following the withdrawal of the UK from the Gemini Partnership at the end of 2012. Sustainability, as the capacity to endure over time, entails operating productively within a balanced budget over the lifetime of the Observatory.

The core goals established by the Gemini Board are:

- to deliver and operate high-quality instruments that represent the priorities of our community;
- to provide a high fraction of queue operations;
- to have ability to remotely operate the telescopes;
- to improve the interface with the partner communities.

We seek to fulfill these goals while retaining some basic operating principles. Among these are: to realize the efficiency gains from operating as two telescopes and one observatory; to conduct regular nighttime observations year-round, every day of the week; to support user scientists, including access to data reduction tools and a science archive; and to maintain an active public information and outreach program.

Elements of Gemini's operation will be to offer four instruments and adaptive optics (AO) capabilities at each site and to provide observations executed by Gemini staff (queue observing) according to user demand. Non-research observers will execute the majority of queue observations. The instrument suite will be refreshed over time, and new instruments must be delivered complete, with full documentation, spares, software, and staff training. Gemini will not provide the resources to repair or recover incomplete instrument deliveries, and no major new in-house development projects are planned.

The main goal of the Transition Plan is to ensure the 2016 budget is met, balanced and sustainable. Specific objectives of the transition plan are to:

- Produce non-labor saving;
- Produce labor saving;
- Maintain science productivity (despite aging instruments);
- Comply with legal or governance requirements;
- Satisfy users;
- Increase smoothness of operation; and
- Produce staff satisfaction.

Gemini must continue to perform well as an organization. This requires having the right skills among the staff to provide a stable knowledge base for routine operations and development, despite a reduction in total staff size. We must maintain a core scientific leadership team while reducing the total research effort and postdoctoral hires. We must maintain engagement and motivation of Gemini employees and ensure that the workload and expectations are commensurate with staff size. The transition also requires Gemini becoming a leaner organization, identifying and reducing waste wherever possible.

7.2 Future Staffing and Budget

7.2.1 Staffing Plan through 2016

The Transition Plan proposes a reduction in the number of full-time equivalents (FTEs) from the current staffing levels. The staffing plan (Table 7-1) shows total labor units of 151.1 FTEs in the final state, as of the beginning of 2016.

Year	2011	2012	2013	2014	2015	2016
FTEs (Jan 1)	201.4	192.9	176.1	166.9	162.1	151.1
FTEs Reductions	-8.5	-16.8	-9.2	-4.8	-11.0	
FTEs (Dec 31)	192.9	176.1	166.9	162.1	151.1	

Table 7-1: Staffing plan overview.

Table 7-2 presents Gemini's planned staffing for the years 2012–2016 in more detail. These values are the basis for the labor costs reported in the long-term budgets. The first part of Table 7-2 shows FTE allocations to the various departments that are funded strictly through O&M contributions. The second part of Table 7-2 presents the staffing plan for Development, which includes all activity managed and coordinated by the Instrumentation Development division and is funded by O&M, IDF, and FDF funds.

FTEs 2012–2016						
Function	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Operations	**174.4**	**159.7**	**156.6**	**150.9**	**147.5**	**140.7**
Administration	30.0	21.2	16.0	15.0	15.0	15.0
Engineering	69.4	62.3	72.8	73.2	71.0	67.9
Science Operations	56.8	53.2	51.1	47.6	46.4	43.7
Sci. Interns and Spotters	2.8	3.3	1.4	0.5	0.5	0.5
Directorate(1)	5.3	10.4	5.7	5.0	5.0	5.0
Public Information/Library	6.8	6.3	6.5	6.5	6.5	6.5
Safety	3.3	2.9	3.1	3.1	3.1	2.1
Development	**27.0**	**33.3**	**19.5**	**16.1**	**14.6**	**10.4**
Total	**201.4**	**192.9**	**176.1**	**166.9**	**162.1**	**151.1**
CAS (FTEs reduction due to CAS)		2.8	10.0	10.0	10.0	10.0
Total FTEs including CAS reduction		*195.7*	*186.1*	*176.9*	*172.1*	*161.1*

Note: (1) Directorate FTEs are high in 2011-2013 due to concurrent presence of multiple Directors and temporary reclassification of Fisher from Science to Directorate FTE.
Table 7-2: Staffing Plan 2012–2016.

Some of the staff reductions in Administration are effectively transfers to CAS. These are noted explicitly at the bottom of Table 7-2.

7.2.2 Partner Contributions 2013–2015

Table 7-3 sets forth estimated contributions by partner for Operations and Instrumentation combined for the period 2012–2015.

Partner	2012	2013	2014	2015	2012-2015 Total
US	21,569,241	18,153,682	21,085,246	21,612,377	82,420,546
UK	7,382,762	0	0	0	7,382,762
Canada	5,623,710	5,623,710	5,623,710	5,623,710	22,494,840
Australia	2,364,799	2,119,934	2,119,935	2,119,935	8,724,603
Argentina	1,058,297	1,078,174	1,098,547	1,119,429	4,354,447
Brazil	908,142	1,711,296	1,754,078	1,797,930	6,171,446
Total	**38,906,951**	**28,686,796**	**31,681,516**	**32,273,381**	**131,548,644**

Table 7-3: Partner Contributions 2012–2015. Values are in US$.

The Transition Plan budget aims to achieve a balanced expense budget through reducing overall expenditures from 2012 to 2015. The goal is financial sustainability after the end of 2015, when a new term for the partnership agreement will begin.

In $1000	2012	2013	2014	2015	2016	Total
O&M	28,226	29,934	29,265	29,256	28,681	145,362
IDF	5,516	6,270	4,609	5,370	3,524	25,289
FDF	1,231	946	1,273	1,346	471	5,267
SBF	76	-	-	-	-	76
Special	95	-	-	-	-	95
Total	**35,145**	**37,150**	**35,147**	**35,972**	**32,676**	**176,091**

Table 7-4: Budget overview, 2012–2016.

Partner contributions presented in Table 7-3 are less than the amount of expenses that Gemini needs for operations and maintenance activities during the period 2013-2015 and presented in Table 7-4. As approved by the Board, Gemini will employ unspent contributions as of December 31, 2012, to fund the planned Operations and Maintenance 2013–2015 budget deficit.

7.2.3 Overall Budget

The total 2012–2016 budget summary in terms of the main budget funds, including spending toward new savings initiatives, is given in Table 7-4. Table 7-5 shows overall spending by cost category.

in $ 1000	2012 Budget	2012 Revised Budget	2013 Budget	2014 Budget	2015 Budget	2016 Budget	Total
DIRECT LABOR	18,366	18,380	17,575	17,239	17,351	16,750	87,296
SUPPLIES/MATERIALS	4,700	3,578	3,714	3,241	2,865	2,788	16,186
TRAVEL	1,735	1,576	1,398	1,256	1,230	1,174	6,633
PURCHASED SERVICES	5,581	5,586	6,202	6,216	6,350	6,477	30,832
SUBCONTRACTED SERVICES	7,376	3,918	6,235	5,447	6,486	3,913	26,000
CAPITAL EQUIPMENT	1,304	1,072	1,036	794	729	684	4,314
AURA MANAGMENT FEE	1,312	1,036	990	954	961	889	4,830
GRAND TOTAL	40,374	35,145	37,150	35,147	35,972	32,676	176,091

Table 7-5: Overall budget by cost category, 2012–2016.

7.3 Transition Program Activities

The Transition Program encompasses the projects that enable the Gemini transition to a new operating mode with reduced budget and staffing in 2016. Figure 7-1 shows the Gantt chart of the core long-term projects. The list below contains the main milestones over the next year for the core projects that will be active in 2013.

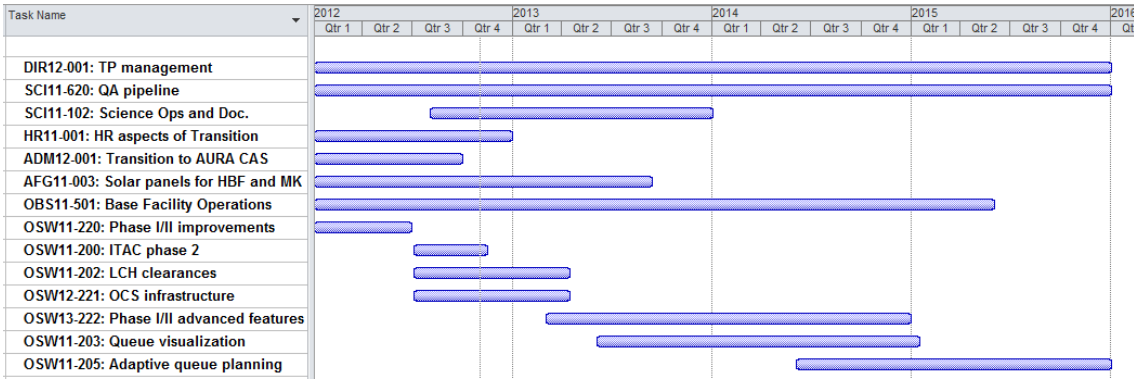

Figure 7-1: Gantt chart of core projects in the Transition Program.

Transition program management

to ensure the transition activities are executed to produce the planned saving for operations and budget stability in 2016

- Finish program planning.
- Establish a basic set of key performance indicators and monitoring tools to control program execution.
- Have the Transition Program Assurance Team support the control, risk monitoring and mitigation, and communications activities of the plan.

Base facility operations

to enable remote operations of telescope from base facilities by 2016

- Complete conceptual design review in 2013Q1.
- Prepare for and complete detailed design reviews in 2013Q3.

Laser Guide Star (LGS) observations clearances

to provide an automatic system to track and enforce Laser Clearing House (LCH) propagation windows and to reduce related queue planning effort

- Automatically generate and submit laser target lists to Space Command.
- Add laser propagation windows to the queue plan for optimal scheduling.
- Prevent laser propagation outside of allowed times and locations.
- Provide shutter warnings, alarms, and visualization for night staff.

Observatory Control Systems (OCS) infrastructure

to upgrade the software infrastructure that supports the OCS, which will reduce maintenance and is a prerequisite to further user software improvements

- Develop project plan and define requirements.
- Replace communications mechanism in client tools.
- Update clients.
- Define future plan for observing database and science program upgrade.

Queue visualization

to provide a graphic representation of the visibilities and instrument configuration of queue observations during a semester to maximize the completion rates with reduced effort

- Prepare the detailed project plan and define long-term milestones.

QA pipeline

to provide rapid data quality assessment during nighttime observing

- Implement generic infrared imaging in Python/Astrodata/Recipe system.
- Complete FLAMINGOS-2 imaging pipeline.
- Use the FLAMINGOS-2 pipeline code for NIRI imaging.
- Image quality assessment for NIRI.
- Generic IR spectroscopy in Python.

Science Operations training and documentation

to enable observing by non-research observers

- Queue observing carried out by non-research observers will reach 50% within 2013.

Solar panels for Hilo Base Facility and Mauna Kea

to reduce electricity consumption

- Get approval from NSF for the requested contract type.

The core transition projects will require around 27 FTEs through 2015 and deliver an annual savings of about $1.3M by 2016, considering both staff effort and non-labor costs. The primary initiatives that contribute to this savings are listed in Table 7-6. Partial savings will begin accruing earlier as projects are completed. Additionally, a list of new initiatives to further reduce annual expenses by around $800k is being reviewed to assess feasibility and resources. Thirteen FTEs are required for these activities. The new initiatives under consideration are to:

- lease vacant space in the Hilo Base Facility;
- eliminate the Free Trade Zone warehouse;
- renegotiate Cerro Pachon kitchen fees;
- revise the relocation policy;
- centralize training budgets;
- upgrade the telescope control software;
- decrease overtime by 10%, including elimination of day crew transition shifts;
- reduce electrical power consumption and system maintenance;
- control spare procurement and management;
- revise the daily telescope checks to require less effort; and
- reduce base facility supplies and maintenance contracts.

Project Name	2016 Savings ($)
Base Facility Operations	688,000
LGS Clearances	11,000
Queue Visualization	32,000
QA Pipeline	80,000
ITAC Phase 2	33,000
Time Accounting Timeline	11,000
Adaptive Queue Planning	31,000
Automated Airplane Detection	159,000
Transition to AURA CAS	235,000
Total	**1,280,000**

Table 7-6: Annual labor and non-labor savings realized from completion of key transition projects. Note that projects completed earlier will provide savings prior to 2016.

The transition plan is monitored quarterly, with some technical progress and financial information reported. A Transition Plan Assurance Team was formed to review the proper execution of the plan. The primary indicators they will use are:

- Budget compliance
  Metric: US$ variance to budget for each activity

- Actual project and activity progress
  Metric: number of transition projects on time / number of transition projects
- Adherence to project resource estimate
  Metric: [(E-A)/E], where E = estimated hours to complete project and A = actual hours to complete project
- Staffing plan health
  Metric: number of staff and monthly turnover

7.4 Operations in 2013

Observatory operations in 2013 will continue to provide support for science users in the international Gemini community, conduct queue and classical observing programs according to user demand, maximize scientific use of the telescopes and instruments, and maintain a data archive. If the upcoming test of eavesdropping is successful, Gemini will implement it as a regular new observing mode. Ongoing work will provide instrument and facility maintenance and administrative support of the Observatory. The public information and outreach program will conduct regular activities, including Journey Through the Universe and StarLab at both sites. The operations projects listed below will be executed on top of these regular operations programs in 2013.

Telescope and Instruments

- Primary mirror coating at Gemini North (2013Q1).
- Safety access platforms ship in 2013Q1, and installed at both sites by 2013Q3.
- Completion of GNIRS lens replacements (2013Q3).

Data reduction

- Data reduction forum open to users (2013Q1).
- First release of Development kit for Astrodata/Recipe system (2013Q1).
- Port Gemini data reduction package to IRAF 2.16 (2013Q1).
- Full public release of the “Unified Release” system for Gemini data reduction package, STScI software, and PyRAF (2013Q1).
- Community release of the Astrodata/Recipe system (2013Q3).

Further Phase I/II software improvements

This work will commence once the OCS Infrastructure has been completed and deliver by end of 2014. Thus, there are no specific milestones for 2013. Note that based on the recent success of the Phase I/II improvement project, the software project development is done in iterations, following an agile development methodology with close interaction between users and developers. The further changes are to provide the following.

- Easier editing of multiple observations.
- Undo/Redo capability.
- Account for all overheads.
- Improve observation summaries.
- Integration with integration time calculator.
- Improved editing functions and user interface.

7.5 Instrumentation Projects in 2013

The list below summarizes the main milestones in the instrumentation projects planned for 2013. The expected decrease in required effort for FLAMINGOS-2 and GeMS will allow support of the other projects. A strict list of priorities is defined to provide guidance during resource allocation.

FLAMINGOS-2
- Complete lab acceptance tests and installation on telescope in 2013Q1.
- Complete nighttime technical and science commissioning for imaging and long-slit modes.
- Release for regular science operations in 2013B.

GeMS/GSAOI
- Finish system verification in January.
- Release to science operations in 2013A.
- Streamline operations during 2013.
- Plan and execute winter shutdown for maintenance and further upgrades (NGSWFS, laser, on-going risk mitigations).
- Install spare deformable mirror zero by end of 2013.

GPI
- Complete and pass acceptance tests in 2013Q1.
- Pre-ship review in April.
- Deliver to Gemini South in 2013Q2.
- Commissioning on telescope in 2013B.

GRACES
- Validate the optical fiber link in 2013Q1.
- Deliver to telescope for commissioning in 2013Q2.
- Offer for science use in 2013B.
- Test prototype system (phase 1) in 2013B to assess end-to-end performance and scientific potential.

GHOS
- Preliminary design phase during 2013.
- Preliminary design review in 2013Q4.

GMOS-CCDs
- Assess shutdown time and site in February (preference to South first, if feasible).
- Implement first set of Hamamatsu CCDs in GMOS in 2013Q3/4.

A&G-2
- Iterate project options with STAC by April 2013.
- Continue work on technical feasibility study (internal or outsourced) and detailed reliability solutions
- Prepare request for proposals by the end of 2013
- Contracted work will happen in 2014–2016.

New instrument
- Prepare elements for next instrument call for proposal by April.
- Issue call for proposals in 2013Q4.

Altair upgrades
- Define modest upgrades aimed at stabilizing performance for the next five years.
- Issue contract for work.

IR detector controller

- Define and implement strategy to provide a new controller for GNIRS (and NIRI).
- Select and purchase hardware.
- Contract software work.
- Total project length will be on the order of two years to have a system in science operations.

GNAO
- Continue exploration of GNAO options, as resources are available.
- Continue discussion with potential collaborators.
- Review trade space of parameters affecting performance.

7.6 Administration in 2013

In addition to regular operations activities, the following list summarizes the main administration projects planned for 2013.

Improve Financial Planning and Reporting Processes
- Define flow for budget preparation and acceptance.
- Coordinate managers' quarterly and annual reports, including detailed information about budget variances.
- Provide budget managers with tools for tracking monthly expenses.
- Deliver financial planning training to budget managers.

Financial Effectiveness and Efficiency
- Implement administrative cost-saving initiatives of Transition Plan.
- Cooperate with CAS, AURA Observatory (in Chile), and NOAO-S to realize savings in administration, facilities, and shared services, especially in fleet, transportation, and base facility operations.

Please contact Gemini Observatory at the address below for any questions about the financial information presented in this annual report or for other inquiries:
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Gemini Observatory
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Hilo, HI 96720

Appendix A. Publications by Staff

In the references that follow in this appendix, numbers in square brackets indicate the position of the staff member in the author list.

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Pessev, P. M.[3]. Evidence for Two Distinct Stellar Initial Mass Functions. *The Astrophysical Journal*, 761:93. December, 2012.

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Appendix B. Publications by Users[2] [3]

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[2] *Gemini maintains an up-to-date database of papers based wholly or in part on Gemini data that appear in the main refereed astronomical research journals. These journals consist of: The Astrophysical Journal, The Astronomical Journal, Astronomy & Astrophysics, Astrophysical Journal, Publications of the Astronomical Society of the Pacific, Icarus, Science and Nature. In a few exceptional and well-assessed cases, we also count papers from "secondary" journals.*

[3] *Gemini's qualifying criterion is the same as that used by Hubble Space Telescope and European Southern Observatory. To qualify, papers based on their output, must employ in an original way an image, spectrum or data set produced by Gemini to derive new scientific results. No attempt is made to fractionate papers per telescope used in the case of papers based on the use of two or more other facilities. Hence, the same paper may be counted several times, for example by Gemini, Keck and Subaru, if it includes data from any of these telescopes.*

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	Night	Rsrch	Instr	User	QC	Day	Other	Mgmt	Impr	Dev	Total
Gemini North											
A. Bluck*	0.09	0.25	0.08	0.07	0.17	0	0.04	0	0	0	0.70
K. Chiboucas	0.09	0.37	0.15	0.06	0.11	0.04	0.09	0	0.01	0.07	1.00
J. Christou*	0	0.11	0.05	0	0	0	0.14	0.05	0	0.19	0.54
T. Geballe	0.19	0.34	0.07	0.17	0	0.07	0.09	0.01	0.05	0	1.00
M. Hartung	0	0.07	0	0	0	0	0	0	0	0.93	1.00
P. Hirst	0.15	0.07	0	0.01	0	0.10	0.27	0	0.37	0.04	1.00
I. Jørgensen	0	0.35	0	0.11	0.05	0.12	0.04	0.29	0.05	0	1.00
S. Kleinman	0	0.13	0	0	0	0	0	0.30	0	0.57	1.00
K. Labrie	0	0.06	0	0.13	0	0	0.37	0.16	0.19	0.09	1.00
S. Leggett	0.08	0.36	0.01	0.33	0.06	0.03	0.10	0	0	0.03	1.00
M. Lemoine-Busserolle	0.05	0.22	0.05	0.19	0.18	0.04	0.15	0	0.04	0.07	1.00
R. Mason	0.18	0.33	0.09	0.01	0	0.04	0.17	0.02	0.15	0	1.00
R. McDermid	0.14	0.40	0.08	0.03	0.18	0	0.10	0	0	0.08	1.00
A. Nitta	0.11	0.21	0	0.13	0.34	0.07	0.10	0	0	0.04	1.00
J. Rhee	0.28	0.33	0.18	0.10	0	0	0.06	0	0.03	0.02	1.00
K. Roth	0.11	0.05	0.29	0.13	0	0.06	0.19	0	0.02	0.14	1.00
R. Schiavon*	0.08	0.33	0.02	0.05	0.05	0.04	0.08	0	0.05	0.04	0.75
A. Stephens	0.15	0.06	0.09	0.20	0	0.03	0.14	0	0.31	0.02	1.00
C. Trujillo	0.15	0.33	0.10	0.05	0	0.06	0.20	0	0	0.12	1.00
Gemini South											
A. Adamson	0	0.04	0	0.02	0	0	0.09	0.83	0.02	0	1.00
R. Carrasco	0.05	0.18	0.01	0.02	0	0.01	0.09	0	0	0.64	1.00
R. Diaz	0.11	0.27	0.02	0.12	0	0.02	0.10	0	0.01	0.36	1.00
G. Gimeno	0.17	0.14	0.35	0.19	0	0.04	0.10	0	0	0	1.00
P. Gomez	0.05	0.30	0.02	0.07	0	0.01	0.07	0	0	0.49	1.00
T. Hayward	0.11	0.20	0.48	0.06	0	0.02	0.10	0	0	0.03	1.00
P. Hibon	0.18	0.33	0.17	0.06	0.08	0.04	0.14	0	0	0	1.00
E. Hogan	0	0.05	0	0.25	0	0	0.24	0	0.13	0.33	1.00
N. Levenson	0	0.04	0	0	0	0	0	0.96	0	0	1.00
S. Margheim	0.14	0.21	0	0.09	0.18	0.02	0.12	0	0	0.25	1.00
B. Miller	0	0.09	0	0.39	0	0	0.21	0	0.29	0.01	1.00
B. Neichel	0	0.10	0.10	0.02	0	0	0.02	0.01	0	0.75	1.00
P. Pessev	0.08	0.30	0	0.06	0.08	0.02	0.13	0	0	0.32	1.00
J. Radomski*	0.11	0.17	0.11	0.07	0.21	0.01	0.14	0	0	0	0.83
F. Rantakyrö	0.14	0.10	0.06	0.09	0.17	0.03	0.12	0	0.01	0.28	1.00
B. Rodgers	0.05	0.10	0	0.09	0.04	0.22	0.07	0.41	0.03	0	1.00
M. Schirmer	0.23	0.42	0.06	0.12	0	0	0.04	0	0.07	0.06	1.00
J. Turner	0.05	0.10	0	0.13	0	0	0.21	0.01	0.49	0	1.00
F. Vidale*	0	0	0	0	0	0	0	0	0	0.21	0.21
C. Winge	0.08	0.13	0	0.07	0.14	0.16	0.13	0	0	0.29	1.00

Table C-1: Research staff distribution of effort, by FTE.

*At Gemini for less than a full year in 2012, so total effort is less than 1FTE.

Appendix C. Staff Research and Achievements

C.1 Distribution of Effort

Table C-1 shows the 2012 distribution of effort for research staff at Gemini Observatory. The categories listed are in order:

- nighttime support of regular science operations

- research
- instrument support
  including instrument maintenance, troubleshooting faults and responding to instrument quality issues, defining calibrations and checkouts, performing non-routine instrument tests, and instrument documentation
- user support
  including direct program support, visiting observer support, response to Helpdesk, and regular semester activities to allocate programs
- queue coordination
  creation of observing plans for queue nights, monitoring of queue programs, and making GMOS instrument configuration decisions
- daytime operations
  including routine Head of Science Operations duties, Gemini Science Archive operations, and unscheduled daytime work
- other operations
  including scheduled non-project staff meetings, career development and training, and outreach activities
- management
- improvement work and small operations projects
- major development projects
  including instrument commissioning

Major development projects, including GeMS, FLAMINGOS-2, and GPI, have occupied many of the science staff at Gemini South. Non-research staff (not listed here) also execute observations and support users and the archive through data quality assessment. In 2012, they completed about 30% of the queue observing at Gemini North and 26% at Gemini South. Their total data quality workload was about 1.3FTE in the North and 1.1FTE in the South.

C.2 Staff Achievements: Invited Talks

R. Diaz
"FLAMINGOS-2 and Gemini Instrumentation," at Universidad Nacional de San Juan (Argentina; March 2012) and Universidad Nacional de La Plata (Argentina; June 2012).

T. Geballe
"Exploring the Central Molecular Zone of the Galaxy using H3+ and CO: July 11, 1997-present" at the Royal Society meeting, "The Chemistry, astronomy, and physics of H3+" (February 10, 2012).
"New Infrared Diffuse Interstellar Bands in the Galactic Center," at ALMA-Santiago, Chile (March 27, 2012), Gemini Science and User Meeting, San Francisco, California (July 17, 2012), and IAU Special Session 16, Beijing, China (August 27, 2012).

M. Hartung
"GPI," at ESO Vitacura, Santiago, Chile (March 2012).
"Gemini reboots", at Center for Adaptive Optics Fall Retreat, Lake Arrowhead, California (November 2012).

P. Hibon

"Narrow-Band Search for z~7 Ly-alpha emitters with IMACS/Magellan," at Laboratoire d'Astrophysique de Marseille, France (June 2012) and Centre de Recherche Astronomique de Lyon, France (June 2012).

S. Leggett
"Reaching nano-Solar Luminosities - Brown Dwarfs with Effective Temperatures from 200K to 2000K, and Gemini's Role in their Investigation," at Gemini Science and User Meeting, San Francisco, California (July 17, 2012).

R. McDermid
"The Atlas3D Survey: Scientific Highlights and Lessons Learned," AIP Conference, Potsdam, Germany, "Galaxy surveys using Integral Field Spectroscopy" (August 2012).
"Stellar Populations in Nearby Massive Galaxies," at the IAU General Assembly, Beijing, China, Symposium 295: "The Intriguing Life of Massive Galaxies" (August 2012).

B. Miller
"Globular Clusters and Nuclei of Dwarf Elliptical Galaxies," at Universidad de Chile, Santiago, Chile (September 13, 2012).

C. Trujillo
"Ices on Minor Planets and Dwarf Planets as Seen Through Gemini," at Gemini Science and User Meeting, San Francisco, California (July 18, 2012).

C.3 Research Staff Results and Plans

Andy Adamson, Associate Director of Operations

Recent Research Results
Adamson has continued to work (at a very low level, given current operational duties) on observational studies of diffuse bands in the visible and infrared. The main collaboration is with M. Rawlings (ALMA), and work this year centered on profile fitting of the J-band (1.18, 1.32 micron) DIBs in echelle-resolution data taken with UKIRT.

Future Research Plans
Adamson anticipates publishing the results of the high-resolution IR spectroscopy described above in 2013. He has recently been invited to co-I a proposal PI'd by D. Figer (Rochester) to characterize and exploit the newly-discovered H-band diffuse interstellar bands (discovered by Geballe et al.) at large extinctions throughout the Milky Way. Adamson contributed to the writing of the proposal and expects to work as a resource for the project team (commenting on reduction and fitting techniques, paper drafts etc.).

Asa F. L. Bluck, Gemini Science Fellow (to September 2012)

Recent Research Results
Bluck published one 1st authored paper: Bluck et al. (2012), *ApJ*, 747, 34
"The Structures and Total (Minor + Major) Merger Histories of Massive Galaxies up to z ~ 3 in the HST GOODS NICMOS Survey: A Possible Solution to the Size Evolution Problem." He submitted one co-authored paper: Conselice et al. (2012), *MNRAS*, submitted, arXiv:1206.6995.
"Gas Accretion as the Dominant Formation Mode in Massive Galaxies from the GOODS NICMOS Survey."

Eleazar Rodrigo Carrasco Damele, Assistant Astronomer

Recent Research Results

Refereed papers:

Lagos, P, Telles, E., Nigoche-Netro, A. and Carrasco, E. R., "Gemini GMOS-IFU spectroscopy of the compact HII galaxies Tol 0104-388 and Tol 2146-391: The dependence on the properties of the interstellar medium", 2012, *MNRAS*, in press.

de Mello, D. F., Urrutia-Viscarra, F., Mendes de Oliveira, C., Torres-Flores, S., Carrasco, E. R. and Cypriano, E. "Star formation in HI tails: HCG 92, HCG 100 and 6 interacting systems", 2012, *MNRAS*, 426, 2441.

Mei, S., et al., "Early-type galaxies at z=1.3. I. The Lynx supercluster: cluster and groups at z=1.3. Morphology and color-magnitude relation", 2012, *ApJ*, 754, 141.

Trujillo, I., Carrasco, E. R. and Ferré-Mateu, A. "Ultra-Deep Sub-kiloparsec View of nearby Massive Compact Galaxies", 2012, *ApJ*, 751, 45.

Submitted papers:

Nilo-Castellón et al. (Carrasco, E. R. – 6th author), "Low X-Ray Luminosity Galaxy Clusters. I. Main goals, sample selection, photometric and spectroscopic observations", 2012, *MNRAS*, submitted.

Nilo-Castellón et al. (Carrasco, E. R. – 6th author), "Low X-Ray Luminosity Galaxy Clusters. II. Optical properties and morphological content at z < 0.5", 2012, *MNRAS*, submitted.

Telles, E., Thuan, T. X., Izotov, Y. I. & Carrasco, E. R. , "A Gemini/GMOS study of the physical conditions and kinematics of the blue compact dwarf galaxy Mrk 996", 2012, *A&A*, revisions to referee comment's submitted.

Conferences:

Carrasco, E. R. "A view of Massive Galaxies with Adaptive Optics", contributed talk in "Galactic Nuclei and their connection with stars and environment" a Conference and Workshop in honor of Professor Miriani G. Pastoriza, Gramado, Brazil, October 22-26 2012.

Future Research Plans

Carrasco will continue the kinematical and dynamical analysis of the massive galaxy cluster Abell 3827, to prepare an article for submission in 2013. The analysis is based on recent GMOS-S spectroscopy of gravitational arcs discovered around the supergiant, multi-component Brightest Cluster Galaxy (BCG) in the cluster (Carrasco et al. 2012, *ApJ*, 715, L160). Another article that includes the analysis of the X-ray data in Abell 3827 is in preparation (Gomez, Carrasco, et al. 2012). Studying properties of massive compact galaxies in nearby and high redshift clusters of galaxies and massive compact galaxies at z>1, Carrasco expects to complete the analysis of one galaxy observed with NIFS/ALTAIR LGS to determine the velocity dispersion robustly. He will publish the results of the spectroscopic survey galaxies and gravitational arcs in the Pandora's galaxy cluster performed with the Magellan telescope and with Gemini. This is a collaboration that includes a large number of people from different institutions.

Kristin Chiboucas, Gemini Science Fellow

Recent Research Results

Recently, Chiboucas has been studying faint dwarf galaxies and ultra compact galaxies. As part of the HST/ACS Coma Cluster Treasury survey she led a project to search for

ultra-compact dwarf galaxies (UCDs) in this rich and dynamically evolved cluster. The team identified a large population of these enigmatic objects and found that these objects have properties more similar to giant globular clusters than dwarf galaxies, suggesting a star cluster origin. More recently Chiboucas has concentrated on a second project, searching for faint and ultra-faint dwarf galaxies in the nearby M81 group, in part to study the faint-end slope of the galaxy luminosity function. Previously, 22 candidate new group members were identified and a paper was published (Chiboucas et al. 2009, AJ 137, 3009). The team has since followed up the candidates with WFPC2 and ACS imaging and confirmed 14 of these as group members. A paper is in preparation, soon to be submitted, on the membership confirmations as well as on the stellar populations of these very faint and small galaxies.

Future Research Plans

After completing the M81 project she will return to the investigation of the origin of UCDs. She still have Keck/LRIS data to reduce and analyze, to be used to confirm a larger sample of these objects and determine ages and metallicities. These properties along with the spatial and velocity distributions will help establish the origin of these objects. In addition, Chiboucas and collaborators have been granted 12 orbits with HST/ACS (GO 12918, PI Chiboucas) to complete imaging in the core of the Coma cluster, as part of their study of the origin of UCDs. They expect to start receiving data in early 2013. Chiboucas is also part of two recently submitted proposals. One is a Keck/DIEMOS proposal to obtain spectroscopy of faint dwarf galaxies and bright UCDs in Coma in order to measure velocity dispersions, and in the case of the UCDs determine whether dark matter may be present. The second is a Gemini/GMOS proposal in collaboration with Jørgensen (also Gemini staff) to obtain spectroscopy of distant, $z > 1$, cluster galaxies to study stellar populations and structural properties at a time when massive galaxies are expected to be undergoing significant evolution.

Ruben Diaz, Assistant Scientist

Recent Research Results

Refereed papers:

"Global and nuclear kinematics of NGC 253" Camperi, J.; Gunthardt, G., Diaz, R.; Aguero, M.; Gimeno, G.; Pessev, P. Boletín de la Asociación Argentina de Astronomía, vol.54, p.377-380. Feb 2012.

"High spatial resolution integral field spectroscopy of Haro 15" Firpo, V.; Bosch, G.; Hagele, G.; Diaz, R. Submitted to *ApJ* on Oct. 2012.

"Metallicity gradients and kinematics of M51 type galaxies" Gunthardt, G.; Diaz, R.; Aguero, E. Submitted to *A&A* on Jul. 2012, now in revision.

Talks and posters at meetings:

"GMOS IFU spectroscopy of the galaxy Haro 15" Firpo, V.; Bosch, G.; Hagele, G.; Diaz, R. Gemini Users Meeting, San Francisco. July 2012.

"Flamingos 2 + GeMS" Diaz, R.; Gomez, P. Gemini Users Meeting, San Francisco. July 2012.

"SAURON's counter-rotating ring and kinematic decoupled cores: How many are just kinematic mirages?" Diaz, R.; Dottori, H. EWASS 2012, European Week of Astronomy and Space Science. Rome, July 2012. To appear in the corresponding proceedings.

"Phoenix high spectral and spatial resolution spectroscopy of the starburst disk in NGC 253," Camperi, J.; Gunthardt, G., Diaz, R.; Aguero, M.; Gimeno, G., Gaspar G.; Pessev, P. Annual Meeting of the Argentinean Astronomical Association, Sep.2012.

"Comparative analysis of radial velocity precision of the spectrographs Phoenix, Flamingos 2, GMOS-S and REOSC-CASLEO," Gaspar, G.; Diaz, R.; Aguero, M.; Camperi, J.; Gunthardt, G.; Gimeno, G. Annual Meeting of the Argentinean Astronomical Association, Sep.2012.
"Flamingos 2 + GeMS," Diaz, R.; Gomez, P. Annual Meeting of the Argentinean Astronomical Association, Sep.2012.
"Preliminary evaluation of a new astronomical site on Don Carmelo Reserve. Site testing, telescope, and the bHROS instrument," Levato, H.; Diaz, R.; Casagrande A.
"Near Infrared mass to light profiles and a new determination of dark halo density distribution in spiral galaxies," Aguero, M.; Diaz, R. Annual Meeting of the Argentinean Astronomical Association, Sep.2012.

Grants and Awards:
Diaz was awarded two Argentinean grants and one international, all of them as co-director or director. One included funding for a postdoctoral researcher under his direction.

Future Research Plans
During 2013 Diaz plans to continue near-infrared, optical and numerical modeling studies of dynamics and evolutionary mechanisms in spiral galaxies, specially the fueling of supermassive black holes and massive star formation in the nuclei of disk galaxies. Most recently he has focused this research onto subprojects that can successfully exploit the future capabilities of FLAMINGOS-2. He will extend to a larger sample a recent successful PhD thesis project (M. Aguero) about dark halo mass distribution in spiral galaxies, a study based on near infrared observations and planned for future exploitation of FLAMINGOS-2 and other near infrared imagers and spectrographs. He will continue with further observations and publication of results of another successfully completed PhD thesis project (G. Gunthardt) on interacting spiral galaxies. The idea is to extend this study to the near infrared domain. Diaz will continue codirecting a multi-partner collaboration based on GMOS IFU observations of giant starforming complexes. The first paper has already been submitted to *ApJ*. Diaz will continue directing the PhD thesis project of Javier Camperi, and the MSc thesis of Gaia Gaspar, who have started to present results at national meetings.

T. R. Geballe, Astronomer

Recent Research Results
"The deep 3.4 μm interstellar absorption feature toward the IRAS 18511+0146 cluster," M. Godard et al. 2012, *A&A*, 537, A27.
"Chemical Analysis of a Diffuse Cloud along the Line of Sight Toward W51: Molecular Fraction and Cosmic-Ray Ionization Rate," N. Indriolo et al., *ApJ*, in press.
"Do R Coronae Borealis Stars Form from Double White Dwarf Mergers?" J. E. Staff et al., 2012 *ApJ* 757, 76.
"Exploring the Central Molecular Zone of the Galaxy using H3+ and CO," T. Geballe et al.
"Recovery and characterization of Neptune's near-polar stratospheric hot spot, G. Orton et al. 2012, *P&SS*, 61, 161.
"Infrared Spectroscopy of CO Ro-vibrational Absorption Lines toward the Obscured AGN IRAS 08572+3915," M. Shirahata et al. 2012, *PASJ*.
"Variable Winds and Dust Formation in R Coronae Borealis Stars" G.C. Clayton et al., submitted to *ApJ* .

"Observations of H2 Formation-driven Grain Alignment in IC 63," B-G Andersson et al . submitted to *ApJ*.

Geballe discovered line emission in four of five members of the IR quintuplet in the Galactic center's Quintuplet Cluster and presented a poster at IAU General Assembly, "Emission Lines in the Near-Infrared Spectra of the IR Quintuplet Stars in the Galactic Center." He is currently writing a paper about this discovery.

Future Research Plans

Geballe will write and submit paper on excitation structure of HH7 bowshock (based on Gemini + NIFS data), as first author. He will apply to continue search for sources in the Galactic center that are suitable for spectroscopy of H3+. Several new candidates are identified. He will fully and uniformly reduce all spectra (obtained at several telescopes), with the plan to publish spectra of "unsuitable" objects, red giants, as they are interesting in their own right. Geballe will apply for GN time to continue GNIRS spectroscopy of hot and massive stars in the Galactic center using GNIRS (this 2012A Band 2 program was not observed). He will Apply for Gemini time in 2013A to continue studies of the Galactic center's gas using H3+. Geballe will apply for time to further characterize the IR diffuse interstellar bands that he and colleagues discovered in 2011. Geballe is PI of 2012B-Q-15, "The Morphology, Chemistry, and Heating of Jupiter's Aurorae via 3-micron Spectroscopy" to be observed in January 2013.

German Gimeno, Assistant Scientist

Recent Research Results

Gimeno obtained Gemini/GMOS-S data from two observing proposals as PI (in a project to obtain imaging and spectroscopy of the compact group of galaxies NGC 6845). Preliminary results from imaging revealed complex structure on the disks of the early-type member galaxies, as well as the presence of dust. These results were presented in the Conference "Galactic Nuclei and their Connection with Stars and the Environment" in October 2012 in Gramado (Brazil). Reduction and analysis of spectroscopy is ongoing. The latter will address the internal kinematics of the early type galaxies. This is an important aspect toward understanding the dynamical evolution of compact groups of galaxies. Gimeno is also working in a collaboration with investigators abroad on kinematics of the gas in nuclear and circumnuclear regions of nearby galaxies, based on NIR observations of another set of Gemini data he obtained in previous years. He presented results in the Argentinean National Astronomy conference on September.

Future Research Plans

Gimeno will continue with the observational investigation of compact galaxy groups and interacting galaxies. The next short- and mid-term steps are to extend the sample of targets to be observed with Gemini (partial observations have been obtained on many on other telescopes) and to employ NIR techniques (including using FLAMINGOS-2 at Gemini). In addition, collaboration with teams in Argentina and Brazil will be started in order to study the properties of galaxies in the observed compact groups with a theoretical approach.

Percy Gomez, Assistant Astronomer

Recent Research Results

Gomez studies cluster mergers by trying to characterize the properties of mergers such as mass ratio, impact parameter, and epoch by combing X-ray, optical, and numerical simulations. In this way, he can determine how accurate the different cluster signals can be used as mass proxies. In the case of AS1063, Gomez and collaborators analyzed multi-wavelength data to uncover a merger in this massive cluster. Then, they used the comparison between velocity data and numerical simulations to try to determine what type of merger is reproducing the observed properties of this cluster. They are also working on a series of papers about the proto-cluster Abell 1882. They are concentrating now on assessing what type of structure it is and what it will become in the future. For this they are using more objective estimators for measuring the mass based on the galaxy velocity data (i.e., the caustic method). Next, they will compare the observations with cosmological simulations (such as the “Millenium Simulation”) as was done for AS1063. They hypothesize that this is a pre-cluster that will form a “Coma" type cluster in the future and would be similar to the ones that have been observed at higher redshift.

The nature of the cluster core region is another line of research. On-going work on the massive cluster Abell 3827 will try to determine the dynamical status of the central galaxy and its properties and compare them with the cluster as a whole, based on near-IR data and optical IFU data. In an upcoming paper that is a detailed study of Abell 3827, the X-ray data show a fairly relaxed cluster. However, the velocity data shows a merger system. It is likely that the merger happened along the line of sight. This system can only be fully understood by the careful comparison of optical and X-ray data.

To explain the effect of mergers on extended radio sources, Gomez obtained some 100 new galaxy velocities for a couple of nearby clusters with wide-angle-tailed radio sources. The goal is to confirm that the velocity needed to produce the ram pressure is produced by a merger. This hypothesis has been recently questioned based on an apparent larger peculiar velocity for the AGNs, which in turn makes a bulk flow motion unnecessary. It has been proposed that buoyancy is a possible mechanism for the jet bending. The team’s on-going work will show that the AGNs are almost at rest in the cluster potential and that a bulk flow is needed for bending. This bulk flow can only be generated by a recent cluster merger.

Future Research Plans

Gomez plans to continue performing cluster research by concentrating on two areas: study of cluster formation and understanding the Intra-Cluster Medium (ICM) dynamics. The ongoing and future multi-wavelength surveys will discover not only large samples of galaxy clusters at different redshifts but also proto-clusters at their forming redshift ($z \sim 2$-3). In order to further understand the process of cluster formation and their effect on the star forming properties of the galaxies Gomez and collaborators will use multi-object near-IR to study a sample of at least 20 forming galaxy clusters. The team will use the spatial and velocity data to determine the presence of substructure and clumpiness, characterize the anisotropy of the velocity dispersion, determine if there is mass conservation during the process of cluster formation, explore the spatial distribution of the star formation throughout these forming clusters, and quantify the proportion of AGNs present in the proto-clusters. We will combine the near-IR data with X-ray and Sunyaev-Zeldovich data in order to compare the clumpiness of the cluster gas and

galaxies, compare the shape of the gas and the halo, and analyze, if possible, the thermodynamical properties of the core of these proto clusters.

Thomas L. Hayward, Telescope Scientist

Recent Research Results
During 2012, Hayward continued as member of NICI Planet-finding campaign, which completed observations in October. He was co-author on 3 campaign papers currently submitted for publication, and has additional papers in preparation. He is a Co-I on NICI program with PI A. Tokovinin (CTIO) to survey Hipparcos binary stars.

Future Research Plans
Hayward plans to continue work on the NICI campaign to analyze data and publish results. He is also a co-I on a NICI queue program with PI E. Nielsen (U. Hawaii) to extend the campaign to further stars. Because NICI is in its final year of service, he will become involved in research with GEMS/GSAOI and GPI. Hayward is also Co-I on proposal to NASA with PI Glenn Orton (JPL) for analysis and modeling of mid-infrared spectra of the 1994 Shoemaker-Levy impact on Jupiter.

Pascale Hibon, Gemini Science Fellow

Recent Research Results
Hibon and collaborators spectroscopically confirmed new high redshift Lyman-alpha emitters at z=6.944. She has been allocated observing time for spectroscopy of z~2-3 Lyman-alpha blobs. She delivered two invited talks in France in June, and contributed a talk to the the EWASS2012 conference in Rome, Italy.

Future Research Plans
Hibon has a new high redshift survey in progress at Las Campanas to find z~7 Lyman-alpha emitters.and is conducting a new survey for z~3 Lyman-alpha blobs. She has launched a new collaboration to use spectroscopic data of high redshift lensed galaxies with colleagues at the CRAL, and has initiated another collaborate with colleagues at the University of Minnesota.

Paul Hirst, Dataflow Scientist

Recent Research Results
Hirst is analyzing data from observations of high redshift quasar candidates. In addition to the record breaking z=7 quasar published in 2011, the team also acquired data on a few other z=6.x quasars, the science analysis of which continues. He has ongoing work reducing and analyzing NICI monitoring observations of SS433 following up from previous work using NACO/VLT which was published in 2011.

Future Research Plans
The five UKIDSS surveys cover a range of the sky area vs. depth parameter space, with the deep surveys (UDS and DXS) observing the same fields many (hundreds to thousands) times over the ~7 year survey duration. This effectively provides a long term monitoring observation of the fields. So far, all the science exploitation of these survey data sets has been based on analysis of the catalogs formed from the deep survey images; the time domain aspect of these datasets has been largely ignored. This area represents a promising and viable field to focus research efforts for the next few years. By re-stacking the data in various size rolling time windows, Hirst and collaborators will

build up source catalogs and thus light curves covering the observable parameter space in image depth vs. sampling frequency. This should provide an efficient way to identify quasars in the fields (as quasars are variable sources typically following a red-noise power spectrum), and thus deduce the quasar fraction as a function of redshift for sources too faint to follow up spectroscopically. This technique has been used by others in the optical. By extending the technique to the near-IR we will also be sensitive to type-2 quasars that would be reddened out of an optical search and capitalize further on the large available UKIDSS data set.

Markus Hartung, Associate AO Scientist

Recent Research Results

Hartung published two papers in 2012 based on observations with NICI, one on binary multiplicity (led by A. Tokovinin) and one with the NICI planet-finding campaign (led by E. Nielson). Another campaign paper has been submitted to *AJ*. He is also co-author of a submitted paper about the rings of Uranus. In addition to these refereed papers, Hartung was a co-author of four SPIE publications related to GPI.

Future Research Plans

Hartung's research focus for the next and half year will be to optimize the performance of GPI. This extreme-AO, high-contrast imager uses tweeter/woofer technology and an apodized Lyot coronagraph to reach ground-breaking contrasts of 10^{-7}.

Inger Jørgensen, Gemini North Head of Science Operations, Tenured Astronomer

Recent Research Results

Jørgensen's main emphasis this year has been on the analysis of data from the Gemini/HST Galaxy Cluster Project, which she leads. The project aims at providing constraints for models of galaxy evolution by establishing a large high S/N data set of spectroscopy and imaging for galaxies in 13 rich clusters spanning from redshift one to the present. In 2012, she finished the analysis of the optical spectroscopy (GMOS-N) and HST/ACS imaging of three of the most massive galaxy clusters in the project with redshifts of z=0.5-0.9. The results have been submitted for publication. The main results are as follows:

(1) For this sample of early-type galaxies in dense environments, there is no significant size or velocity dispersion evolution with redshift, at a given mass. This is in disagreement with results for less dense environments.

(2) The Fundamental Plane (M/L vs. Mass) is consistent with passive evolution and mass (velocity dispersion) dependent formation redshifts: z_{form}=1.24□0.1 and 1.95□0.25 for low and high mass galaxies, respectively. The result for high mass galaxies is in agreement with previous studies for high mass galaxies. No previous results exist for large samples of low mass galaxies to these redshifts.

(3) The Balmer lines are weaker than expected from the M/L vs. Mass offsets resulting in z_{form}>2.8 if assuming passive evolution, confirming a previous result based on a smaller sample of intermediate redshift galaxies.

(4) Ages, [M/H] and [□/Fe] derived from the line indices show that one of the clusters have metallicity about 0.2dex below that of the low redshift sample, while another cluster have abundance ratios of [α/Fe] about 0.3dex above that of the low redshift sample. Under the assumption that the intermediate redshift galaxies are the progenitors of the low redshift sample, both results are in contradiction with passive evolution. This adds to the increasing evidence that there are cluster-to-cluster differences and that passive

evolution is a much too simple model for the evolution of early-type galaxies over the last half of the age of the Universe.

In addition to this work, Jørgensen published on paper in MNRAS and presented at the January AAS meeting.

Future Research Plans
Jørgensen plans to complete the data processing and analysis of the remaining data from the Gemini/HST Galaxy Cluster Project and prepare the results for publication over the next 2-3 years. The immediate emphasis will be on the highest mass clusters in the sample in order to quantify the possible cluster-to-cluster differences. In parallel she is defining and planning a long-term project seeking to answer questions about the evolution of the galaxy evolution in clusters at even higher redshift (earlier times). With the discovery of rich clusters out to $z \approx 2$, and the availability of near-IR MOS instruments, it is now possible with 8-meter class telescopes to obtain spectra that make it possible derive kinematics (and therefore masses), ages and metallicities for large samples of individual galaxies at redshifts between 1.2 and 2. These observations will span the epoch of the galaxy formation where it is thought that the largest changes in star formation rates and morphology take place. The project will involve an international group of collaborators (including Chiboucas also Gemini staff) and make use of both Gemini and VLT instrumentation. Gemini time has been granted in 2013A to start the project.

Scot Kleinman, Head of Instrumentation Development

Recent Research Results
Kleinman submitted a paper entitled, “SDSS DR7 White Dwarf Catalog” this year and expects it will be accepted shortly. In this work, the team reports on the analysis of over 20,000 white dwarf spectra from the SDSS, roughly double the number of white dwarf stars previously known. They identified about 3% of these as magnetic white dwarf stars and measured a significantly different mean mass for the DA (H outer atmosphere) vs. the DB (He) white dwarf stars. Kleinman also contributed to several papers led by others.

Future Research Plans
Obvious possible next steps are adding a supplement to cover DR8 (the last of the SEGUE data releases) and start DR9 (the first APOGEE release). There are also new variable candidates to observe, unique WDs to study, etc. He is most likely to lead only the first of these.

Kathleen Labrie, Associate Scientist

Recent Research Results
Labrie collaborators (R.L. Webster, Matt O'Dowd, Floyd, D., N.F. Bate, H. Landt, and A. Ruff) are using a new technique for probing the kinematic properties of the broad emission line region and accretion disc of high redshift quasars using differential microlensing. They have shown that substantial information can be gained through a single observation of a strongly lensed quasar using integral field spectroscopy.

Future Research Plans
Next year's objective is to complete the reduction and preliminary analysis of the GMOS IFU data that has already been collected. A data paper is expected to come out of that work.

Sandy Leggett, Tenured Astronomer

Recent research results
Leggett's primary research area is observational studies of brown dwarfs. She continues to classify late-type T dwarfs, objects with effective temperatures (Teff) between 500K and 1000K, found in the UKIRT Infrared Deep Sky Survey (UKIDSS). Including recent discoveries, more than 40% of all T6-T9 dwarfs known have been found in UKIDSS data. Other recent work presents Gemini optical photometry and spectroscopy, and Subaru 3 micron spectroscopy, for a sample of T dwarfs, including the coolest T dwarf UGPS 0722. The authors show that the dwarf has Teff = 505K, mass 3 - 11 Jupiter-masses, and an age between 60 Myr and 1 Gyr. At these temperatures the neutral alkali gas is expected to condense out as chlorides, however the GMOS spectrum shows clearly detected lines of Cs and Rb, which are emitted from deep atmospheric layers with temperatures of 900K - 1200K.

The coolest brown dwarfs currently known have Teff between 300K and 500K. These are prototype Y dwarfs. Leggett and collaborators have identified a metal-poor T dwarf in WISE observations and have established a method for identifying candidate Y dwarfs at the low S/N limits of the WISE data. They have demonstrated that for the Y dwarfs chlorides and sulfides have condensed in the atmosphere and have formed clouds that significantly reduce the emergent flux at 1 micron. Accurate NIRI photometry proved crucial for the latter study.

NIRI photometry also contributed to a study with University of Hawaii researchers to analyze two brown dwarfs found to be binary systems using Keck laser adaptive optics imaging. These two systems are the coldest known substellar multiples, having secondary components of about 400 K and being planetary-mass binaries if their ages are 1 Gyr or less.

Leggett's secondary research area is observational studies of white dwarfs, the faint, small and high gravity end-point of stellar evolution for the vast majority of stars. This year Leggett worked with a team led by M. Kilic identifying debris disks around white dwarfs, using Spitzer IRAC photometry and spectroscopy obtained at the IRTF. They showed that the average total mass accreted by these stars ranges from that of 200km asteroids to Ceres-sized objects, indicating that white dwarfs accrete moons and dwarf planets as well as Solar System asteroid analogues.

Leggett's familiarity with low mass stars and Gemini instrumentation led to her joining a group led by W. Herbst, studying the edge-on binary T Tauri system KH 15D and its circumbinary ring. They used CTIO light curves, Keck radial velocities and GNIRS spectral energy distributions to show that the trailing edge of the occulting dust ring has precessed such that star B is now visible. The results also suggest that the ring is truncated by a sub-stellar object such as an extremely young giant planet.

Future research plans
The Herbst group continues the study of KH 15D, in order to determine the spectral characteristics of the putative giant planet and to search for spectral signatures of the ring.

Leggett intends to use the results of NIRI and GMOS 12B observations to conclude a project characterizing cool white dwarf candidates identified in the UKIDSS LAS database. The cool white dwarfs are of necessity old, and act as a probe of the thick disk and halo remnant population. Her group has been refining our selection techniques and have to date identified seven thick-disk 10 - 11 Gyr-old white dwarfs; we hope to add to this sample using the Gemini 12B data.

Leggett is part of a team led by M. Cushing that was awarded 695 hours of Spitzer time to monitor the known sample of Y dwarfs for photometric variability. The proposed observations will determine and characterize any mid-infrared variability exhibited by the Y dwarfs and determine whether the variability evolves over time scales of many months. These observations will not only improve our understand of the atmospheric dynamics of brown dwarf atmospheres but also directly inform the interpretation and characterization of cool gas giant exoplanets detected with the next generation of high-contrast imagers like the Gemini Planet Imager (GPI) and the SPHERE instrument for the VLT.

Leggett is also lead on two NIRI 13A proposals to obtain photometry of Y dwarfs. One proposal is to obtain accurate YJHK photometry for the known Y dwarfs lacking in such data, for ongoing characterization, and the other is a monitoring program designed to complement the Spitzer program by measuring any near-infrared variability exhibited by the Y dwarfs. The disappearance of the chloride and sulfide clouds is expected to lead to variability at 1 micron, whereas if the surfaces have 5 micron hotspots similar to Jupiters, then rotational modulation could lead to significant mid-infrared variability. Obtaining the near- to mid-IR color information for the variability will enhance interpretation of the data, and provide crucial input for the next generation of models.

Marie Lemoine-Busserolle, Gemini Science Fellow

Recent Research Results

In order to build a comprehensive picture of the physical properties of populations of distant galaxies, and to set constraints on the galaxy formation and evolution scenarios, Lemoine-Busserolle is carrying out a global multi-wavelength study of the galaxies at $z \geq 1$. The main scientific goal is to constrain the morphology, structure, kinematics, dust content, star formation rate (SFR), metallicity, luminosity, mass functions and stellar population of young galaxies, using the same parameter space and indicators as for the local field galaxies. This could be achieved through two major research programs:

1. The pioneering work started during her PhD shows that massive clusters acting as gravitational telescopes are a powerful tool in the study of the physical properties of the faint end of the luminosity function at high redshift. However, the current data sets are still too small to give constraints on the galaxy evolution scenarios. Thus, Lemoine-Busserolle has designed a research program to carry out a near-infrared 3D spectroscopic follow up of distant lensed galaxies. She recently presented the results of the 3D kinematics of a z~1.3 "clumpy" lensed galaxy at the 2012 STScI May Symposium.
2. A second program complements the study of intrinsically faint lensed galaxies by targeting brighter sources in the field (like the Lyman Break Galaxies) for spatially-resolved spectroscopy. She was allocated ~ 8 hours on Gemini in 2012B and has submitted a new proposal for 2013A.

Future Research Plans
Lemoine-Busserolle's plans are to publish the results presented at the 2012 STScI May Symposium and to obtain spatially-resolved spectroscopy data on additional $z \geq 1$ star-forming galaxies.

Nancy A. Levenson, Deputy Director and Head of Science

Recent Research Results
Levenson's research concentrates on the dusty surroundings of active galactic nuclei (AGN). She was co-author of two papers in this field in 2012, a significant survey of low-luminosity AGN led by Rachel Mason, and a detailed broad-wavelength study of NGC 1365 led by Alumdena Alonso-Herrero. Work on the unusually luminous "green bean" galaxies (led by Mischa Schirmer) will appear in the *ApJ* in 2013. Levenson served on two meetings' Scientific Organizing Committees, for the Gemini Science and User Meeting in San Francisco, California, and for the Torus Workshop, in San Antonio, Texas.

Future Research Plans
The mid-infrared imager, spectrometer, and polarimeter, CanariCam, is being commissioned at the Gran Telescopio Canarias. Levenson is a member of the CanariCam Science Team and Los Piratas collaboration, which will use this instrument to obtain observations of complete samples of AGN at the wavelengths where the AGN-heated dust emission dominates. Detailed ground-based analyses of nearby AGN will be used to account for biases of all-sky observations (such as those obtained with the WISE satellite), which lack spatial resolution to isolate the active nuclei. Levenson is also a member of the collaboration to use GNIRS to obtain broad-NIR coverage spectroscopy of the important Palomar sample of AGN.

Steven Margheim, Assistant Scientist

Recent Research Results
The presence of large amounts of lithium in 1-2% of evolved red giants demonstrates either a very short-lived or rare mechanism that provides for the production or deposition of Li in the atmospheres of these stars. Owing to the paucity of li-rich red giants discovered, primarily in the field, we have been unable to determine the physical mechanism(s) responsible. It is strongly desired to obtain large sample of these stars in globular clusters, which would also provide precision information about the stellar parameters and evolutionary state of each star. Previously, this work has required prohibitively large amounts of telescope to obtain the necessary sample sizes of 5,000-10,000 stars. Using Gemini/GMOS in a high-resolution mode, coupled with a SII imaging filter used as a spectral blocking filter, one can obtain spectra of 300-400 cluster red giants in modest (~1 hour) amounts of time. A pilot program was observed in 2011 and the initial results presented early in 2012. The team has been able to detect Li-rich members of M22 at the expected rate of 1-2% of the sample. Final data reduction of the full sample and results are expected in late 2012, early 2013.

Future Research Plans
A similar survey for lithium-rich red giants in the Galactic Bulge was begun in 2012B, in collaborations with NSF science fellow Christian Johnson. Margheim and collaborators expect to sample 10,000 bulge stars in the next 1-2 years and develop a robust sample of the phenomenon in this population. A final set of bHROS data of extremely metal-

poor halo stars has been processed and the analysis of the lithium 6-to-7 isotopic ratio has begun in collaboration with V. Smith at NOAO. Results and publication(s) are expected in 2012.

Rachel Mason, Assistant Astronomer

Recent Research Results

Mason published the first paper to establish the overall near- to mid-IR properties of low-luminosity AGN (LLAGN) at high spatial resolution. This compilation of new and archival observations of ~20 LLAGN allowed evaluation of the mechanisms responsible for the IR emission. The data are suggestive of optically thin dust and low dust-to-gas ratios, in agreement with models predicting that LLAGN do not host a Seyfert-like obscuring torus.

Future Research Plans

Mason is leading a near-IR spectroscopic survey of Palomar AGN. The spectra, taken with the 0.85-2.5 micron cross-dispersed mode of GNIRS, are being used to investigate areas including (1) accretion disk and dust signatures in LLAGN; (2) stellar populations and the role of AGB stars in the near-IR; (3) the signatures of low-mass stars and a bottom-heavy IMF; (4) line excitation mechanisms and their relation to AGN demographics; and (5) the anomalous P and Ca emission in AGN. The reduced data and reduction tools will be made available to the public through the group's website.

Richard McDermid, Gemini Science Fellow/Assistant Scientist

Recent Research Results

The Atlas3D project is a complete, volume-limited survey of 260 nearby early-type galaxies using integral-field spectroscopy and other spatially resolved multi-wavelength data to characterize the properties of massive evolved galaxies at the current epoch. The survey continues to yield interesting results, a highlight of which was the discovery of a systematic variation in the initial mass function (IMF) of the sample galaxies. This work was co-led by Cappellari and McDermid, and appeared in *Nature* this spring. A number of Atlas3D follow-up projects were executed using Gemini this year, including spectral verification of new tidal dwarf candidates and exploration of the infrared stellar populations. Results from GMOS IFU mapping of a galaxy discovered by Atlas3D to have a large outflow of molecular gas yielded publication in Davis et al. 2012, and will be summarized in an upcoming Gemini*Focus* article.

The Coma3D survey is a new project to map a complete sample of 170 objects in the Coma cluster, lead by Michele Cappellari (Oxford) and McDermid. This survey is focused on quantifying the kinematic properties of galaxies in a dense cluster, to explore the role of environment in the evolution of angular momentum in galaxies. Also, being at essentially fixed distance and having IFU data, this project should establish a new benchmark for galaxy scaling relations at the current epoch. The team began observing this year, with 16 nights allocated. Only half of these were useful, unfortunately, yielding around 50 objects so far – already enough for a first result. They hope to continue the observing campaign this year.

Future Research Plans

Ongoing work with the Atlas3D Project continues, including constructing spatially resolved star formation histories of the 260-galaxy sample for comparison with other multi-wavelength data from the survey. From this the team will map and compare

multiple star formation tracers, to try to infer how star formation has declined in these objects in the recent past. If time allocation is granted, McDermid will continue accruing data for the Coma3D Survey – a new IFU survey of the Coma cluster. The team is targeting 170 objects, of which it currently has around 50. This survey is targeting the characterization of stellar kinematics and galaxy scaling relations in this benchmark cluster. If more time is not granted, they will proceed with publishing what they have. McDermid will lead the stellar population analysis. In smaller collaborations, McDermid will progress with infrared observations of Atlas3D galaxies to explore stellar population properties at these longer wavelengths. He will also progress on proprietary HST spectra of nuclear star clusters in nearby nucleated early-type galaxies.

Bryan W. Miller, Tenured Astronomer

Recent Research Results
Miller completed data reduction of Lick standard stars taken with GMOS-N/S, and final analysis in underway. This will provide calibration of GMOS B600 spectra to the Lick line index system for measuring ages and metallicities for unresolved stellar populations. A draft paper has been written. It should be submitted soon, and the processed spectra will be made public.

Future Research Plans
Once the Lick calibration work is completed, Miller will finish a paper on GMOS spectroscopy of globular clusters in Virgo and Fornax Cluster dE galaxies. Future plans include using the new GSAOI and FLAMINGOS-2 instruments on Gemini South to study globular clusters and dwarf galaxies in the near infrared.

Benoit Neichel, Adaptive Optics Scientist

Recent Research Results
In 2012, Neichel worked on vibration control and mitigation in AO systems. He characterized atmospheric parameters based on MCAO data. He characterized the sodium layer, for laser guide star performance. He further calibrated and optimized the MCAO system. He published two papers in refereed journals in 2012 and submitted another. He also contributed to ten publications in SPIE, three as first author and five as second author.

Future Research Plans
Neichel will continue to work on these areas in 2013. He will also work on point spread function reconstruction and astrometry precision, both in MCAO.

Atsuko Nitta, Assistant Scientist

Recent Research Results
Nitta presented "Comparing two mode identification techniques in a DB white dwarf" at a conference, "Progress in physics of the sun and stars: a new era in helio- and asteroseismology." She worked on data reduction magnetic and massive white dwarf stars (from Gemini data). Nitta finished reducing GN-2012A-Q-30 data and is half-way through reducing GN-2012A-Q-108 data, but struggling to understand artifacts seen in all data around Hgamma. (It is probably related to the amplifier, but unclear why it does not come out in reduction.) Nitta discovered few new magnetic white dwarf stars and waiting for a collaborator to give detail physical parameter estimate from the reduced

data. One of the targets has now been confirmed to be the most or second most massive pulsator known via data from McDonald observatory.

Future Research Plans
Nitta will finish writing the paper on comparing the two mode identification techniques. She will reduce and analyze the 12AQ108 and 12AQ109 data. She will analyze the HST data on UV spectra of He atmosphere white dwarf pulsators (DBVs) obtained in Cycle20. (Nitta is a co-I on the program.) She would also like to continue her work on DB instability strip, especially on establishment of the hot end of the instability strip.

Peter Pessev, Gemini Science Fellow

Recent Research Results
Evidence for two distinct stellar mass functions was found in a sample of Local Group star clusters (Zaritsky et al. 2012), hinting towards significant gaps in our understanding of stellar populations' properties and evolution. This result has the potential to affect multiple fields of modern astronomy, spanning from the studies of resolved stellar populations in the nearby galaxies to the high-redshift Universe. Taking into account the relatively small number of objects studied, the team is pursuing expansion of the sample. A paper in preparation (Zaritsky et al. 2013) is addressing in depth the potential influence of certain stellar population properties on this result. This paper also expands the sample using Milky Way globular cluster data. Submitted work (with Meyer) summarizes results about near-infrared integrated-light photometry of Large Magellanic Cloud young populous clusters that are particularly important to test and calibrate the simple stellar population models used to study unresolved star clusters and galaxies. New results about the multiple star clusters in the Magellanic Clouds will also be published.

Future Research Plans
Pessev will develop a database of Magellanic Cloud star clusters metallicities based on the calcium triplet method using GMOS-S at Gemini South. He will expand the sample of integrated-light high-resolution spectra used to detect the two initial mass functions mentioned above.

Fredrik T. Rantakyrö, Associate Scientist

Recent Research Results
Rantakyrö was co-author of two SPIE papers based on GPI (one on the pipeline and one on the integration and testing results) and one paper using the VLTI to study the Be star 48 Lib. The latter includes spectroscopic, polarimetric, and high spectral resolution interferometric data covering the period 1995-2011, which were analyzed to document the transition into a new phase of circumstellar disk activity in the classical Be-shell star 48 Lib. This allowed a test of disk oscillations as the basic underlying dynamical process.

Future Research Plans
Rantakyrö co-authored an article based on SEST and ATCA observations, "Millimeter dust emission compared with other mass estimates in N11 molecular clouds in the LMC," submitted in the middle of the year. A second updated version was submitted at the end of November. Rantakyrö will also be studying Be stars that have larger extended decretion disks and the companions using the non-redundant mask mode of

the GPI instrument. He will also work closely with the GPI Campaign team in using the GPI instrument.

Jaehyon (Jay) Rhee, Assistant Scientist

Recent Research Results

(1) The oldest surviving stars with the lowest metal abundances are astrophysical laboratories that may shed essential light on the origins and evolution of the chemical elements and on the formation of the Milky Way. Using high-resolution spectra taken with the KPNO 4m/Echelle, Rhee and collaborators have recently confirmed the discovery of six field, extremely metal-poor stars with $-3.3 < [Fe/H] < -2.80$ (including two stars located even at lower Galactic latitudes).

(2) Rhee and collaborators have recently utilized the Gemini/NIFS to determine carbon isotope abundances (^{12}C and ^{13}C) for 18 giant stars in the globular clusters M13 through medium-resolution (R ~ 5300) K-band spectroscopy. Comparing the carbon isotope ratios of the first and second generation stars in globular clusters will permit systematic tests of contemporary cluster chemical evolution models.

(3) Rhee and colleagues presented GALEX data for 44 Galactic globular clusters obtained during three GALEX observing cycles between 2004 and 2008. This is the largest homogeneous data set on the UV photometric properties of Galactic globular clusters ever collected.

Future Research Plans

(1) Over the past decade, Rhee and collaborators have obtained optical high-dispersion spectra of some 65 very metal-poor stars in the Galactic halo and thick disk using the Magellan 6.5m, KPNO 4m, and CTIO 4m telescopes. They will continue their analysis on these data and publish some results in journals.

(2) The team plans to present initial results of our analysis on the Gemini/NIFS spectra of 18 giants in M13 during the upcoming AAS meeting. They expect to collect K-band spectra of seven RGB and AGB stars in the globular cluster M68 utilizing the Gemini/GNIRS in 2012B. They will analyze these K-band spectra of giant stars in the two globular clusters and publish the results.

Bernadette Rodgers, Gemini South Head of Science Operations

Recent Research Results

Rodgers continued progress toward a publication of Herbig Ae/Be companions, with Thomas and others. This will report the results of an extensive survey to determine multiplicity of 142 intermediate mass pre-main sequence stars. She served as Co-Investigator on a Director's Discretionary time proposal to observe light echoes of Eta Carinae (PI A. Rest). Her research work is largely on hold due to the demands of managing Gemini South science operations during this challenging period of bringing new science capabilities into operations.

Future Research Plans

Rodgers will complete publication of extensive multiplicity survey of Herbig Ae/Be stars and attend Protostars & Planets VI in July 2013.

M. Schirmer, Gemini Science Fellow

Recent Research Results

Schirmer discovered a sample of about 20 Seyfert-2 galaxies with galaxy-sized and ultra-luminous narrow-line regions (NLR) at intermediate redshifts (z=0.2-0.6). Initial VLT/XSHOOTER long-slit spectroscopy of the brightest galaxy in the sample allowed for a 2D spectroscopic analysis, showing that the entire NLR (25x40 kpc) is powered by AGN radiation. A spectroscopic pilot survey of the rest of the sample with GMOS-S reveals that the AGN characteristic also holds for the other galaxies. They are all radio-weak or radio-quiet, with NLR sizes on the order of 20 kpc or more. The VLT data reveals large variations in dust extinction, as expected for a Seyfert-2 galaxy. The data also suggest that an AGN merger might take place. For example, we observe multiple peaks in [OIII] and in the ionisation parameter, and gas kinematics shows that the NLR is very turbulent. However, ionisation peaks, together with peaks in electron density could also be caused by a jet interacting with the intergalactic medium.

More intriguingly, the overall [OIII] luminosities are extremely high. With L=9x10^43 erg/s the NLR of the brightest galaxy in the sample is the most luminous NLR ever found around any Seyfert-2 galaxy. It is as bright as the most luminous NLR found in a sample of 800+ SDSS quasars. It is unlike any other narrow line region known, and distinct from so-called extended emission line regions (EELRs) which are typically found around radio-loud quasars. For example, EELRs have more chaotic structures and appear outside their host galaxies, and much lower dynamical line widths. The NLRs Schirmer and colleagues observe in their sample, however, appear to form the main body of the galaxy. Judging from the [OIII] luminosity alone, they would expect to observe a very luminous quasar; however, that is not the case. Currently, the most plausible explanation is that they might be observing a light echo from a very luminous quasar, which has very recently shut down, or at least reduced its luminosity by ~2 orders of magnitude in less than a galaxy's light crossing time. More details can be found in a publication in press.

Future Research Plans

To verify this scenario, Schirmer will obtain X-ray observations of several of these galaxies to evaluate the current state of the AGN, and to look for possibly other, hidden AGNs in the same objects. Also, IFU observations with GMOS-S in very good conditions have already been scheduled in 2012B. His other research activities focus on the redshift determination of two strong lensing systems, one in a fossil group of galaxies, and the other in a high-redshift double galaxy cluster. In both cases the lensed sources are in the redshift desert and require near-IR spectroscopy to secure their redshifts. The fossil group is particularly interesting, as the lensing geometry (and other multi-wavelength data) allows the study the group's internal structure and dark matter halo, and in this manner constrains the formation of future brightest cluster galaxies. The double galaxy cluster at z=0.66 is interesting as both member clusters appear to have relatively low masses, but are at a different stage of formation. One of them is much more concentrated and features an impressive giant lensed arc (only few clusters at this or higher redshifts are known to have giant arcs), whereas the other cluster is less concentrated without any strong lens configuration. This is a nice example to see how cluster sub-structure can affect the lensing cross-section and has to be taken into account when using arc statistics as a cosmological tool. Four nights at SOAR have been granted in 2012B to study those two objects.

Andrew Stephens, Assistant Astronomer

Recent Research Results

Stephens, working with R. Schiavon, is using Gemini North with NIRI, GNIRS and Altair to study individual globular clusters stars in the Andromeda galaxy. High spatial-resolution NIRI + Altair natural guide star (NGS) near infrared (NIR) photometry of M31 globular clusters is used to construct color-magnitude diagrams (CMDs) of the clusters' upper giant branches. These CMDs are used to determine cluster membership and select spectroscopic targets. GNIRS + Altair is used to obtain NGS cross-dispersed NIR spectra in order to determine elemental abundances of the individual clusters stars. These abundances are calibrated using medium resolution NIRI spectra of cool giants in three Galactic globular clusters spanning a range of metallicities ($-1.2 < [Fe/H] < -0.2$). The C, N, and O abundances provide important preliminary constraints on the history of star formation of the M31 halo. Comparing these abundances to those of young M31 disk stars, Stephens and collaborators are assessing the chemical evolution of M31 over the past 10 billion years. A detection of multiple stellar populations in the first M31 cluster may be an exciting result that will provide preliminary tests of model predictions for cluster formation. Stephens also collaborates with astronomers in Chile studying variable stars in Galactic globular clusters and astronomers in the UK searching for supernovae progenitors.

Future Research Plans

The M31 cluster photometry and Galactic cluster spectra will be analyzed and published in 2013. The M31 cluster spectroscopy is ongoing and should be finished in 2012B with a publication goal of 2014.

Chad Trujillo, Tenured Astronomer

Recent Research Results

Trujillo's recent research results as Principal Investigator include the completion of a large survey of Kuiper Belt Object colors. The main goal is to identify primitive ices on Kuiper Belt Object surfaces, possibly remnants of the planet forming era in the solar system. The first publication of this work appeared in 2011, and the second is in preparation. In addition, Trujillo has acted as a co-author on several projects including constraining the mutual orbits of Kuiper Belt Object binaries (PI Grundy), main belt comets (PI Hsieh), and the colors of primitive cold classical Kuiper Belt Objects (PI Sheppard).

Future Research Plans

Trujillo's primary focus for the next year or two is a project to search for more Sedna-like objects in the solar system. There is currently only one object in the solar system with a perihelion (closest approach) significantly larger than 50 AU and that is Sedna, with an extremely distant closest approach of 76 AU. This is more than double most other Kuiper Belt Objects which have perihelion around 30 AU. It is very difficult to explain Sedna's origin with current dynamical models and Sedna's existence may indicate an early encounter by another star during the planet formation epoch of our solar system. Because of Sedna's unusual nature, there may be many other Sedna-like objects that are unseen, possibly exceeding the Kuiper Belt in mass. Currently Sedna is the only object this extreme, and Trujillo is working to find more such objects. This is part of a NASA-funded grant using large telescopes (Magellan, Subaru, the Blanco 4-m at CTIO, Gemini). In addition, he has a few other projects in progress. These include a project to

determine the composition of Pluto's moons Nix and Hydra, as well as a second project to constrain the compositions of the irregular satellites of Saturn.

James E. H. Turner, Assistant Scientist

Recent Research Results
Turner completed IFU data reduction for an ongoing study of low-redshift E+A galaxies with GMOS (as PI), to constrain possible E+A transition mechanisms by comparison with numerical simulations including stellar population synthesis codes.

Future Research Plans
Future work will be the analysis and publication of data from the above project, and involvement in 12B/13A GMOS proposal (Schirmer et al.) to study ultra-luminous narrow-line regions in galaxies lacking identifiable quasar nuclei, testing the hypothesis that they are echoes of a faded QSO and constraining the physical conditions associated with AGN shut-down.

Fabrice Vidal, AO Science Fellow

Recent Research Results
Work has been done on the stability of the Laser Guide Star (LGS). It has been shown now that the LGS constellation alignment meets the requirements and does not affect the AO loop stability and its performance.

Future Research Plans
Vidal's main goal is to develop a data software processing on GeMS/GSAOI, using the real behavior of the instrument from the data recorded on-sky. No deep characterization of the system has been done so far. Therefore it is crucial to have a good knowledge of the current capabilities of the instrument before starting regular operations in 2013b. The current main effort is to synchronize and record all the statuses, calibrations, and reliable data among all the sub-systems that will be used for the data processing. Automated software is currently in its development phase and will be able to provide live error budget, turbulence profiling and help the telescope operator point out if the system is working properly or not. This software will be tested during the system verification and provide a deep analysis after the SV campaign. Data provided by GeMs will be also very helpful for the specifications of the future generations of AO instruments since GeMS is currently the only science instrument of its kind in the world. A second phase will be dedicated to improve the loop performance. Another task is to simplify and gather all the essential functionalities of the Canopus AO bench in a minimal software interface. Currently, the MYST software interface is only usable by AO experts.

Claudia Winge, Associate Scientist

Recent Research Results
Winge published one refereed paper in 2012, "Short Timescale Variations of the Hα Double-peaked Profile of the Nucleus of NGC 1097,"Schimoia et al, 2012 *ApJ* 748 145.

Future Research Plans
Winge has four ongoing collaboration projects. First, with Sales et al,, a high spatial resolution MIR spectroscopy of AGN with the objective to study the torus properties in the 8-12mu region. The team has been using T-ReCS (with large success) and MICHELLE (with no success) and the retirement of both instruments has effectively

ended this quite productive project (two papers published in the last 1-1/2 year, one more likely to be accepted in the next few weeks, and the team has new (2012A/B) data in hand). The team has been considering applying for Subaru/COMICS time as an option. Second, with Riffel et al, they are using high spatial resolution NIR/IFU spectroscopy of AGN with evidence of gas inflows/outflows in the inner regions to study the feeding/feedback effects of the active nucleus. Third, with Krabbe et al, they are conducting detailed gas kinematic and abundances of interacting galaxies, including N-body modeling of the system evolution. This project started with and it is based mostly in GMOS-S band 4 data. Fourth, Winge is engaged in a survey of unconfirmed pairs in the Arp-Madore Atlas of interacting galaxies. The team has about 50 new pairs/systems observed, but the project has been hibernating for the last year, given lack of time from all members in the group. Pastoriza and Sales now have new students, so they plan to move forward in 2013. In addition, three papers have been submitted or are in preparation.

Appendix D. Science Programs 2011B and 2012B

GN Scientific Ranking 2011B Classical and Band 1

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2011B-C-1	Bean	US	The C/O and Metallicity of the Hot Jupiter Wasp-12b	GMOS-N	15
GN-2011B-C-4	Koyama	Subaru	Physical Origin of Dusty Starbursts in the Cluster Outskirts at z=0.4	GMOS-N	20
GN-2011B-C-6	Kuncarayakti	Subaru	GMOS integral field spectroscopy of nearby Ib/c supernova sites	GMOS-N	10
GN-2011B-C-5	Moskovitz	US	The near-Earth encounter of asteroid 2005 YU55	Michelle	15
GN-2011B-C-2	Salyk	US	Observations of water vapor in planet-forming regions	Michelle	20
GN-2011B-C-3	Stanghellini	US	The HII region population in M81 and the evolution of the radial metallicity	GMOS-N	10
GN-2011B-Q-1	Bailey	AU	The D:H Ratio of Jupiter, Uranus and Neptune	GNIRS	9.6
GN-2011B-Q-2	Barmby	CA	The M31 abundance gradient	GMOS-N	16
GN-2011B-Q-3	Berger	US/GS	Exotic Explosions and Eruptions: Exploring a New Transient Phase-	GMOS-N	12
GN-2011B-Q-4	Breton	CA	Measuring the Masses of Pulsars with Irradiated Companions (North)	GMOS-N	10
GN-2011B-Q-5	Burningham	GS/UK	Solving the late-T dwarf luminosity function discrepancy	GNIRS	11.8
GN-2011B-Q-6	Collins	UK	Measuring the dynamical mass of a Brightest Cluster Galaxy at z=1.26	GNIRS	30
GN-2011B-Q-7	Cushing	US	Northern Hemisphere Follow-up Observations of WISE Brown Dwarf	GNIRS	37.7
GN-2011B-Q-8	Duchene	US	Towards a complete census of brown dwarfs in IC 348	GNIRS	20.6
GN-2011B-Q-9	Fischer	US	\centering A Pilot Study of Mid-IR Molecular Outflows in AGN	GNIRS	7.5
GN-2011B-Q-10	Fox	AU/GS	Late-time Observations of Exceptional Swift and Fermi GRBs: Gemini S	NIRI	3
GN-2011B-Q-11	Galicher	CA	Confirming a 23 AU Jovian planet candidate around a nearby young and	NIRI	5
GN-2011B-Q-12	Geballe	GS	Additional Probes of the Galactic Center's Interstellar Medium -	GNIRS	7.5
GN-2011B-Q-13	Gilbank	CA	The Redshift One-plus GMOS Ultra-deep Emission line Survey (ROGUES)	GMOS-N	10
GN-2011B-Q-14	Grundy	US	Mutual Orbits and Masses of Kuiper Belt Binaries and Multiple Systems	NIRI	12.5
GN-2011B-Q-15	Hirst	GS	The highest-redshift quasars in the UKIDSS LAS	GMOS-N	4
GN-2011B-Q-16	Hsieh	UH	The Sublimation-Driven Nature of Main-Belt Comet Activity	GMOS-N	3
GN-2011B-Q-17	Hsieh	UH	Characterization of the Active Behavior of Main-Belt Comets	GMOS-N	13.4
GN-2011B-Q-18	Jha	US	Adding to the Treasury: Spectroscopic Classification of High-Redshift	GMOS-N	7.8
GN-2011B-Q-19	Kerzendorf	AU	The Last Hope - Searching for Type Ia progenitors in Tycho's Supernova	GNIRS	2.5
GN-2011B-Q-20	Kriek	US	Physical Properties of z$\sim$1.5 Galaxies as a Function of Spectral	GNIRS	17.5
GN-2011B-Q-21	Lidman	AU	Improving Type Ia supernovae as distance indicators	NIRI	3.3
GN-2011B-Q-22	Marois	US/CA	Altair/NIRI L-band Imaging of a Fifth Planet Around HR 8799	NIRI	13.5
GN-2011B-Q-23	McLure	UK	Spectroscopic confirmation of a z=7.7 galaxy	GNIRS	30
GN-2011B-Q-24	Muratore	AR	Kinematics of B[e] supergiant stars' disks	GNIRS	0.9
GN-2011B-Q-25	Navarete	BR	Dynamical Masses of MYSOs	NIFS	8.4
GN-2011B-Q-26	Okoshi	Subaru	Faint emissions from heavy absorbers II: NIR imaging spectroscopy	NIFS	7.5
GN-2011B-Q-27	Richstone	US	Probing the Envelope of the Black Hole Mass - Galaxy Dispersion	NIFS	12
GN-2011B-Q-28	Roe	US	Titan's Methane Weather post-Equinox: Seasonal climate change	NIRI	6
GN-2011B-Q-29	Sales	BR	On the Nature and Distribution of Dusty Material in Active Galactic	Michelle	2.8
GN-2011B-Q-30	Shih	UH	Massive Outflows in FR II Quasars and Radio Galaxies	GMOS-N	9.6
GN-2011B-Q-31	Smith	UK	Constraining the low-mass IMF in benchmark low-z strong-lens	GNIRS	8
GN-2011B-Q-32	Stanghellini	US	The HII region population in M81 and the evolution of the radial metallicity	GMOS-N	0.8
GN-2011B-Q-33	Stockton	UH	Low-z Analogs to High-z Compact Early-Type Galaxies	GNIRS	16
GN-2011B-Q-34	Tanvir	GS/UK/AU/US	Investigating gamma-ray bursts and their use as cosmological probes	NIRI	28
GN-2011B-Q-35	Tecza	UH/UK	High-Contrast NIFS spectroscopy and NIRI photometry of a low-mass	NIFS	10.2
GN-2011B-Q-36	Thalmann	US	A Complete Image of the LkCa 15 Disk Gap	NIRI	3
GN-2011B-Q-37	Tonry	UH	Type Ia Supernova Science with SuperNovAe Cross Correlation Filters	GMOS-N	9
GN-2011B-Q-38	Tucker	AU/US	Catching Supernovae in the Act with KISS (Kepler International Supernova	GMOS-N	18

GN Scientific Ranking 2011B Band 2

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2011B-Q-39	Aspin	UH	ToO Observations of Recently and Newly Discovered Young Eruptive	NIRI	8
GN-2011B-Q-40	Bannister	AU	Hunting Signatures of Cryovolcanism on Charon	GNIRS	2
GN-2011B-Q-41	Bartlett	US/UH	Planck SZ Clusters: Follow-up of the Planck Galaxy Cluster Catalog	GMOS-N	21
GN-2011B-Q-42	Bersier	UK	The Supernovae of Gamma-Ray Bursts: Exploring the diversity of	GMOS-N	6
GN-2011B-Q-43	Burningham	AU	Solving the late-T dwarf luminosity function discrepancy	GNIRS	5.9
GN-2011B-Q-44	Crenshaw	US	Resolving the Mechanisms of Feeding and Feedback in Nearby AGN	NIFS	11
GN-2011B-Q-45	Currie	US	NIRI Imaging of Transitional Protoplanetary Disks with Submm-	NIRI	15
GN-2011B-Q-46	de Mooij	CA	High precision measurements of thermal emission and reflected light	GMOS-N	14.8
GN-2011B-Q-47	Emery	US	Near-IR photometry of KBOs and Centaurs in support of Spitzer space	NIRI	14
GN-2011B-Q-48	Farina	AR	H2 emission linked to massive young stellar objects in NGC 604	GNIRS	5.6
GN-2011B-Q-49	Foley	US	The Most Precise Distances to Type Ia Supernovae	GMOS-N	12.9
GN-2011B-Q-50	Fraser	UK	Detecting the progenitors of core collapse supernovae - precision	NIRI	3
GN-2011B-Q-51	Geballe	GS	Search for Direct Evidence of Upwelling CH4 from the South Polar	GNIRS	1
GN-2011B-Q-52	Geballe	GS	H3+ as a probe of the nuclear diffuse gas of NGC1068	GNIRS	3
GN-2011B-Q-53	Geballe	GS	Spectroscopy of the 3.4-micron hydrocarbon region toward the	GNIRS	1
GN-2011B-Q-54	Glazebrook	GS/CA/US	Local counterparts to high-redshift turbulent galaxies: what are the stellar	GMOS-N	32
GN-2011B-Q-55	Grundy	US	Mutual Orbits and Masses of Kuiper Belt Binaries and Multiple Systems	NIRI	12.5
GN-2011B-Q-56	Hall	CA	Weak Line Quasars at High Redshift: Anemic Broad-line Regions or	GNIRS	12
GN-2011B-Q-57	Herbst	GS/US	Near Infrared Spectroscopy of the Unique T Tauri Binary System KH 15D	GNIRS	4.1
GN-2011B-Q-58	Hilton	UK	The Evolution of Galaxy Cluster Mass-Observable Scaling Relations	GMOS-N	18.3
GN-2011B-Q-59	Irwin	UK	Seasonal changes in Uranus' atmosphere	NIFS	4.5
GN-2011B-Q-60	Kavelaars	CA	Stellar Occultations of Large Kuiper Belt Objects - Astrometric Solutions	GMOS-N	9.9
GN-2011B-Q-61	Mackey	AU/CA/UK	Dynamics of the accreted remote globular cluster system of M31	GMOS-N	25
GN-2011B-Q-62	McDermid	US/UK	Feedback in action: mapping the molecular outflow in NGC1266 with	NIFS	9
GN-2011B-Q-63	McDermid	GS/UK	Searching for Carbon Star Signatures in Early-Type Galaxies	GNIRS	18
GN-2011B-Q-64	Morales-Calderon	US/GS	Confirmation and Characterization of Four New Low-Mass Pre-Main-	GNIRS	35.6
GN-2011B-Q-65	Muzerolle	US	Periodic Protostellar Variability: Testing the Pulsed Accretion	GNIRS	5
GN-2011B-Q-66	Penny	AU	A transforming galaxy in the core of a rich cluster: galaxy transformation	GMOS-N	1.4
GN-2011B-Q-67	Perlmutter	AU/UK	Galaxy Cluster Supernovae at z~0.5: Dissecting the Hubble Diagram	GMOS-N	5
GN-2011B-Q-68	Phillips	US	Near-Infrared Spectroscopic Followup of Type Ia Supernovae in the Hubble	GNIRS	10
GN-2011B-Q-69	Rapoport	AU	Investigating GRB-SN connection for real GRBs	GMOS-N	16.2
GN-2011B-Q-70	Rich	UH	An Integral Field Study of U/LIRGs	GMOS-N	9
GN-2011B-Q-71	Riffel	BR	Two-Dimensional Stellar Populations in Active Galaxies using NIFS	NIFS	8.6
GN-2011B-Q-72	Riffel	BR	A new method to trace young stellar populations	GNIRS	8.8
GN-2011B-Q-73	Ryder	AU	Extinction towards Supernovae 2010O and 2010P	NIRI	3.2
GN-2011B-Q-74	Schiavon	GS	CNO Abundances in Resolved M31 Globular Clusters Stars	GNIRS	8
GN-2011B-Q-75	Smartt	UK/UH	Ultrabright optical transients : giant supernova in dwarf hosts	GMOS-N	10
GN-2011B-Q-76	Spencer	US	The Nature of the Hydrated Material on Europa	NIFS	6
GN-2011B-Q-77	Thalmann	CA/UH	A Complete Image of the LkCa 15 Disk Gap	NIRI	6.1
GN-2011B-Q-78	Thomas	US	Confirming Q-type asteroids in the main asteroid belt	GNIRS	11
GN-2011B-Q-79	Trujillo	GS	Primordial Solar System Ices	NIRI	6.3
GN-2011B-Q-80	Wegner	US	The dark matter density of elliptical galaxies in voids	NIRI	4

GN Scientific Ranking 2011B Band 3

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2011B-Q-81	Bastien	CA	Acceleration in a T-Tauri jet?	GMOS-N	2.5
GN-2011B-Q-82	Beck	CA	Circumstellar Gas in Proto-Solar Nebula Analogs	NIFS	6.4
GN-2011B-Q-83	Bonavita	CA	Supermassive Planets or Ultralight Brown Dwarfs? A New Population of	NIRI	20
GN-2011B-Q-84	Bresolin	UH	Chemical abundances in the outer disks of spiral galaxies	GMOS-N	9
GN-2011B-Q-85	Chapman	US	GNIRS spectroscopy of HDF259, a candidate z=6.3 sub-millimetre	GNIRS	2.3
GN-2011B-Q-86	Connelley	UH	Understanding the Mass Building Phase of Protostellar Evolution using	NIFS	12
GN-2011B-Q-87	Couch	AU	The Build-up of the Red Sequence in Galaxy Clusters	GMOS-N	7.5
GN-2011B-Q-88	de Pater	US	ALTAIR/NIRI AO Imaging of Volcanic Eruptions on Io	NIRI	9.5
GN-2011B-Q-89	Faifer	AR	Compact Elliptical Galaxies in the Pegasus Group?	GMOS-N	1
GN-2011B-Q-90	Geballe	GS	Additional Probes of the Galactic Center's Interstellar Medium -	GNIRS	7.5
GN-2011B-Q-91	Gregorio-Hetem	BR	Mixing of young and older stellar clusters in CMa R1	GMOS-N	5.8
GN-2011B-Q-92	Hatch	UK	A study of environmental effects in a z=2.5 proto-cluster	NIRI	7
GN-2011B-Q-93	Hebb	US	Defining the M dwarf Mass-Radius relation as a function of activity and	GNIRS	49
GN-2011B-Q-94	Irwin	UK	Dynamics of Neptune's atmosphere	NIFS	9
GN-2011B-Q-95	Kilic	US	The Two Shortest Period Detached Binary White Dwarfs	GMOS-N	2.5
GN-2011B-Q-96	Koss	US	Searching for Compton-Thick Dual AGN In Extremely Close Mergers	GMOS-N	0.7
GN-2011B-Q-97	Landt	AU	A near-IR relationship for estimating AGN black hole masses	GNIRS	4.9
GN-2011B-Q-98	Lemoine-Busserolle	GS	The connection between Star Formation and AGN in galaxies at z~2	GNIRS	9.2
GN-2011B-Q-99	Mason	GS	What causes the low 7.7/11.3 micron PAH ratios in low-luminosity AGN?	NIRI	3.5
GN-2011B-Q-100	Melin	UK	Detecting auroral H3+ emission from Uranus	GNIRS	24
GN-2011B-Q-101	Milisavljevic	US	Resolving SN Ejecta Asymmetries with High-Dispersion Spectra	GMOS-N	6.5
GN-2011B-Q-102	Riffel	BR	Feeding and Feedback in nearby AGN: The case of Mrk 620 and Mrk 607	NIFS	4.4
GN-2011B-Q-103	Sainz	AR	Astrochemistry of Young Brown Dwarfs Proto-Planetary Disks	GNIRS	3.1
GN-2011B-Q-104	Sonnett	UH	Surface Properties of Trans-Neptunian Misfits	NIRI	13
GN-2011B-Q-105	Sromovsky	US	Probing Uranus' Atmosphere With Discrete Cloud Observations	NIRI	8
GN-2011B-Q-106	Wainscoat	UH	Physical properties of large bodies in the outer solar system	GNIRS	10

GN Scientific Ranking 2011B Band 4

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2011B-Q-107	Proctor	BR	Stellar populations and kinematics of BCGs in fossil groups	GMOS-N	6
GN-2011B-Q-108	Sullivan	UK	The Host Galaxies of Local PTF Type Ia Supernovae	GMOS-N	54
GN-2011B-Q-109	Titov	AU	Testing the standard cosmology with Very Long Baseline Interferometry	GMOS-N	21.2
GN-2011B-Q-110	Zhang	UK	Spectroscopic observation of cool subdwarf binaries in the Galatic halo	GMOS-N	14.6

GS Scientific Ranking 2011B Classical and Band 1

Gemini ID	PI	Partners	Title	Instrument	Hours
GS-2011B-C-5	Eisenhardt	US	Spectroscopy and Imaging of a Complete Sample of WISE	GMOS-S	20
GS-2011B-C-1	Menanteau	US/CL	Mass Calibration of a Sample of ACT SZE-Selected Galaxy Clusters	GMOS-S	50
GS-2011B-C-3	Merline	US	High-Resolution AO Imaging of Asteroids/Satellites	NICI	10
GS-2011B-C-2	Metchev	US	A Sensitive Search for Exozodi Across the Ten-Micron Silicate Feature	T-ReCS	10
GS-2011B-C-4	Sakon	Subaru	Mid-Infrared Late Epoch Observation of Dust Forming Novae	T-ReCS	10
GS-2011B-C-6	Stubbs	US	Spectroscopy of Galaxies in Massive Clusters: \\ Galaxy Properties and	GMOS-S	40
GS-2011B-Q-1	Anderson	CL	Rapid ToO spectroscopy of very young supernovae	GMOS-S	10
GS-2011B-Q-2	Bailey	US	A search for the perturbing planets in large gap debris disks	NICI	8

GS-2011B-Q-3	Berger	US/GS	Exotic Explosions and Eruptions: Exploring a New Transient Phase-	GMOS-S	12
GS-2011B-Q-4	Bersier	UK	The Supernovae of Gamma-Ray Bursts: Exploring the diversity of	GMOS-S	6
GS-2011B-Q-5	Breton	CA	Measuring the Masses of Pulsars with Irradiated Companions (South)	GMOS-S	10
GS-2011B-Q-6	Carrasco	CA/BR/US/UK/GS	Constraining the Mass of the Spectacular Pandora's Cluster, Abell	GMOS-S	19.8
GS-2011B-Q-7	Cobb	GS	Late-time Observations of Exceptional Swift and Fermi GRBs: Gemini South	GMOS-S	2
GS-2011B-Q-8	Crotts	US	Spectroscopic Evolution of SNR 1987A \& Its Light Echo	GMOS-S	11
GS-2011B-Q-9	Cucchiara	UK/GS/AU/US	Exceptional Swift and Fermi GRBs: Gemini South Rapid Targets of	GMOS-S	14
GS-2011B-Q-10	Donzelli	AR	Stellar Populations in Extragalactic Globular Clusters	GMOS-S	3.7
GS-2011B-Q-11	Fletcher	UK/GS/US	Jupiter's Global Dynamics a Decade after Cassini: Spectroscopic Mapping	T-ReCS	16.5
GS-2011B-Q-12	Gaensicke	UK/GS	Aiming very low: The mass-radius relation of a He-core white dwarf and	GMOS-S	7.2
GS-2011B-Q-13	Gibson	UK	Probing the atmosphere of a hot-Saturn exoplanet with differential	GMOS-S	6
GS-2011B-Q-14	Glazebrook	AU	Local counterparts to high-redshift turbulent galaxies: what are the stellar	GMOS-S	14
GS-2011B-Q-15	Howell	UK/US	Type Ia supernovae: the progenitor revolution	GMOS-S	9
GS-2011B-Q-16	Hwang	US	Spectroscopic Study of New Extended Star Clusters in NGC 6822	GMOS-S	15
GS-2011B-Q-17	Irwin	BR/GS	A Potential Post-Tidal Disruption Event by an Intermediate-Mass Black	GMOS-S	8
GS-2011B-Q-18	Jha	US	Adding to the Treasury: Spectroscopic Classification of High-Redshift	GMOS-S	15.2
GS-2011B-Q-19	Kraus	US	Resolving planet-cleared gaps in transitional/pre-transitional disks	T-ReCS	7
GS-2011B-Q-20	Levenson	GS	A Complete AGN Sample to Test Unification	T-ReCS	13.1
GS-2011B-Q-21	Maund	US	Return to the site of the Type IIP Supernova 2008bk	GMOS-S	3
GS-2011B-Q-22	Minezaki	Subaru	Mid-infrared imaging of lensed QSOs to decipher subhalos -- the final	T-ReCS	7.5
GS-2011B-Q-23	Nagar	CL	Tracing gas flows in Active Galactic Nuclei down to the innermost few	GMOS-S	7
GS-2011B-Q-24	Naud	US/CA	A Planet Search around Young-associations M dwarfs (PSYM survey)	NICI	22
GS-2011B-Q-25	Pignata	CL	Characterizing subluminous Supernovae Ia through nebular	GMOS-S	5
GS-2011B-Q-26	Rabus	CL	Search for warm dust and sub-stellar companions at the astronomical unit	NICI	4
GS-2011B-Q-27	Roe	US	Titan's Methane Weather post-Equinox: \\ Seasonal climate change	NICI	4
GS-2011B-Q-28	Sahu	US	Detecting Isolated Black Holes through Astrometric Microlensing	GMOS-S	3
GS-2011B-Q-29	Sales	BR	On the Nature and Distribution of Dusty Material in Active Galactic	T-ReCS	2.2
GS-2011B-Q-30	Schaefer	US	Solving the Type Ia Supernova Progenitor Problem By Identifying the Ex-	GMOS-S	12.5
GS-2011B-Q-31	Servillat	UK/AU	What feeds the intermediate mass black hole HLX-1 in ESO~243-49?	GMOS-S	8.3
GS-2011B-Q-32	Smartt	UK	Ultrabight optical transients : giant supernova in dwarf hosts	GMOS-S	10
GS-2011B-Q-33	Stubbs	US	Spectroscopy of Galaxies in Massive Clusters: Galaxy Properties and	GMOS-S	5.5
GS-2011B-Q-34	Thompson	US	High Spatial Resolution MIR Spectroscopy of Seyfert Nuclei	T-ReCS	6.2
GS-2011B-Q-35	Tinney	CL/UK/AU	Imaging companions from the Anglo-Australian Planet Search	NICI	19.3
GS-2011B-Q-36	Torres-Flores	CL	Star formation in the intragroup medium and metallicity gradients in	GMOS-S	8
GS-2011B-Q-37	Werk	US	Finding the Edge of the Galactic Wind's Influence	GMOS-S	12
GS-2011B-Q-38	Wilson	CA	The Gemini Cluster Astrophysics Spectroscopic Survey (GCLASS)	GMOS-S	9.5

GS Scientific Ranking 2011B Band 2

Gemini ID	PI	Partners	Title	Instrument	Hours
GS-2011B-Q-39	Anguita	CL	Mass to light ratios and evolution of galaxy scale lenses from the RCS2	GMOS-S	22
GS-2011B-Q-40	Artigau	CA	Following the traces of the little man	NICI	1.8
GS-2011B-Q-41	Bai	CA	The zRCS Deep Group Survey	GMOS-S	35
GS-2011B-Q-42	Bessiere	UK	The evolution of quasar host galaxies	GMOS-S	12.6
GS-2011B-Q-43	Cenko	US	Probing the Central Black Holes of Distant, Quiescent Galaxies via Tidal	GMOS-S	3
GS-2011B-Q-44	Chornock	US	Host Galaxies of the Most Luminous Supernovae Found by PAN-STARRS1	GMOS-S	2
GS-2011B-Q-45	Desert	US	Searching for high altitude absorbers in the atmospheres of two hot Jupiter	GMOS-S	12
GS-2011B-Q-46	Drake	US	Lumnious Optical Transients and their Progenitors	GMOS-S	12

GS-2011B-Q-47	Edge	UK	The balance of star-formation and AGN activity in the most distant	GMOS-S	25
GS-2011B-Q-48	Foley	US	The Most Precise Distances to Type Ia Supernovae	GMOS-S	12.9
GS-2011B-Q-49	Hagele	AR	The CNSF rings of Seyfert galaxies and their connection with the active	GMOS-S	5
GS-2011B-Q-50	Hilton	UK	The Evolution of Galaxy Cluster Mass-Observable Scaling Relations	GMOS-S	24.4
GS-2011B-Q-51	Hsieh	US	The Sublimation-Driven Nature of Main-Belt Comet Activity	GMOS-S	6
GS-2011B-Q-52	Kilic	US	The Two Shortest Period Detached Binary White Dwarfs	GMOS-S	4.5
GS-2011B-Q-53	Leggett	GS	z-band imaging of GJ 3483B: defining the blue end of a cold spectrum	GMOS-S	9.9
GS-2011B-Q-54	Makler	BR	Gemini follow-up of strong lensing systems discovered on the CFHT	GMOS-S	4
GS-2011B-Q-55	Margheim	GS	The Lithium Depletion Boundary and Age of the Southern Open Cluster	GMOS-S	10
GS-2011B-Q-56	Martioli	BR	Direct Imaging of Exoplanet Candidates to Explore the Mass-	NICI	8
GS-2011B-Q-57	Melis	US/CA	A Search for Giant Planets around a Nearby, Young, Low-mass Star	NICI	3
GS-2011B-Q-58	Milisavljevic	US	Resolving SN Ejecta Asymmetries with High-Dispersion Spectra	GMOS-S	3.3
GS-2011B-Q-59	Motta	GS/CL	Isothermal or not isothermal: Discriminating different density	GMOS-S	11.4
GS-2011B-Q-60	Pandian	US	Mid-infrared morphologies of massive young stellar objects	T-ReCS	10
GS-2011B-Q-61	Pastoriza	BR	The Nature of Two Giant HII Region (GHIIR) in the Minor Merger AM2306-	GMOS-S	5.4
GS-2011B-Q-62	Rapoport	AU	Investigating GRB-SN connection for real GRBs	GMOS-S	16.2
GS-2011B-Q-63	Rebassa-Mansergas	UK/CL	Searching for close double white dwarfs in the Sloan Digital Sky Survey	GMOS-S	15
GS-2011B-Q-64	Rupke	US	Looking for QSO Feedback: Two's a Company, Three's a Crowd	GMOS-S	8
GS-2011B-Q-65	Sivakoff	CA	Revealing the Black Hole in a Globular Cluster of the Elliptical Galaxy NGC	GMOS-S	4
GS-2011B-Q-66	Stern	US	Spectroscopic Confirmation of Spitzer-Selected Galaxy Clusters at	GMOS-S	5
GS-2011B-Q-67	Subasavage	GS/US	The Hidden Radial Velocity Companion to the Nearby Halo Star	GMOS-S	5.4
GS-2011B-Q-68	Thomas	US	Confirming Q-type asteroids in the main asteroid belt	GMOS-S	3.3
GS-2011B-Q-69	Tokovinin	GS	Confirming Hipparcos Astrometric Companions with NICI AO imaging	NICI	14.8
GS-2011B-Q-70	Ueta	US	Probing of the Structure of Proto-Planetary Nebulae with Angular	NICI	6
GS-2011B-Q-71	Vieira	BR	Chemical evolution of dust in Herbig Ae/Be stars	T-ReCS	3.3
GS-2011B-Q-72	Wilson	US	The Gemini Cluster Astrophysics Spectroscopic Survey (GCLASS)	GMOS-S	9.5

GS Scientific Ranking 2011B Band 3

Gemini ID	PI	Partners	Title	Instrument	Hours
GS-2011B-Q-73	Angeloni	CL	Resolving Symbiotic Nebulae in the Magellanic Clouds: a GMOS survey	GMOS-S	4
GS-2011B-Q-74	Artigau	CA	PSYM-wide: a search for wide-separation planetary companions to	GMOS-S	22
GS-2011B-Q-75	Bian	US	Rest-frame UV Spectra of the most UV luminous Lyman Break Galaxies at	GMOS-S	15
GS-2011B-Q-76	Chapman	UK	GMOS Followup of Thermal Upturn AGN/HyLIRGs from the SPT survey	GMOS-S	20
GS-2011B-Q-77	Chhetri	AU	Search for Gravitational Lenses in the Southern Hemisphere	GMOS-S	9.5
GS-2011B-Q-78	Couch	US/AU	Dynamical masses of superdense massive galaxies in the local universe	GMOS-S	30
GS-2011B-Q-79	Goad	UK	Toward a census of BAL variability	GMOS-S	22.1
GS-2011B-Q-80	Koss	US	Searching for Compton-Thick Dual AGN In Extremely Close Mergers	GMOS-S	4.9
GS-2011B-Q-81	Levato	AR	The nature and evolutionary status of the B[e] candidates of the LMC	GMOS-S	2.2
GS-2011B-Q-82	More	CA	Study of SL2S galaxy groups: mass distribution and concentration-mass	GMOS-S	15
GS-2011B-Q-83	Richtler	CL	The dark halos of isolated elliptical galaxies	GMOS-S	13.9
GS-2011B-Q-84	Rodgers	GS	Targeting Southern Hemisphere Objects with T-ReCS	T-ReCS	16.7
GS-2011B-Q-85	Salinas	CL/AU	Galactic taphonomy: kinematics, stellar populations and dark matter	GMOS-S	16.5
GS-2011B-Q-86	Schiavon	GS	Probing the Nature of LINER emission from Early-type Galaxies	GMOS-S	4
GS-2011B-Q-87	Scott	US	Galaxies and AGN in the Field of the UV Bright QSO HE2347-4342	GMOS-S	17
GS-2011B-Q-88	Telesco	US	Resolving an Asteroid Belt in a Multi-Planet System	T-ReCS	5.6
GS-2011B-Q-89	Urrutia	BR	Stars outside galaxies: HII regions in two shell galaxies with HI tidal debris.	GMOS-S	6
GS-2011B-Q-90	Zijlstra	UK	[WR] star in a close binary system	GMOS-S	2.5

GS Scientific Ranking 2011B Band 4

Gemini ID	PI	Partners	Title	Instrument	Hours
GS-2011B-Q-91	Beers	BR/US	A Survey for Unrecognized Carbon-Enhanced Metal-Poor Stars in the	GMOS-S	75
GS-2011B-Q-92	Chene	CL	Search for new Galactic LBV candidates	GMOS-S	12
GS-2011B-Q-93	Chene	CL	Spectroscopic Follow-Up Observations of Bow Shock-Producing Stars	GMOS-S	5

GN Scientific Ranking 2012A Classical and Band 1

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2012A-C-1	Miller	UK	Molecular line excitation in the near infrared spectrum of	GNIRS	20
GN-2012A-C-2	Veilleux	US	Spectroscopic Follow-up of z $\sim$ 8 Lyα Emitters	GNIRS	10
GN-2012A-C-3	Nagao	Subaru	A Search for Chemically Young QSOs in High-z	GNIRS	20
GN-2012A-Q-1	Willott	CA	Spectroscopic confirmation of redshift 7 quasars to probe	GNIRS	11.6
GN-2012A-Q-2	Wang	US	Near-Infrared Integral Field Spectroscopy of an AGN Pair	NIFS	2.6
GN-2012A-Q-3	van Kerkwijk	CA	Tidal synchronization and dissipation in the shortest	GMOS-N	19.5
GN-2012A-Q-4	Tucker	US/AU	Catching Supernovae in the Act with KISS (Kepler	GMOS-N	16.9
GN-2012A-Q-5	Toshikawa	Subaru	Searching for Protoclusters at z~6	GMOS-N	7.5
GN-2012A-Q-6	Tonry	UH	Investigating SNIa Systematics with PS1	GMOS-N	16.0
GN-2012A-Q-7	Thanjavur	CA	Characterizing the gravitational lens geometry of	GMOS-N	5.3
GN-2012A-Q-8	Tanvir	UK	Lyman-alpha imaging of a known z=8.2 field -	NIRI	15.0
GN-2012A-Q-9	Tanvir	GS/AU/US/UK	Late-time Observations of Exceptional GRBs: Gemini	NIRI	7.0
GN-2012A-Q-10	Straka	UH	"3-D" Mapping of Star Formation and Kinematics in	NIFS	6.5
GN-2012A-Q-11	Smartt	UK/UH	Ultrabright optical transients : giant supernova in dwarf	GMOS-N	10.0
GN-2012A-Q-12	Shih	UH	Massive Outflows in FR II Quasars and Radio Galaxies	GMOS-N	12.0
GN-2012A-Q-13	Seth	US	VCC~1254: A fat black hole in a wimpy galaxy?	NIFS	8.1
GN-2012A-Q-14	Satyapal	US	The Lowest Mass Supermassive Black Hole in	GMOS-N	2.5
GN-2012A-Q-15	Rupke	US	QSO Feedback in Action: Surveying Large-Scale QSO	GMOS-N	13.0
GN-2012A-Q-16	Rupke	US	QSO Feedback in Action: The Inner Structure of a Large-	NIFS	10.0
GN-2012A-Q-17	Rothberg	US	Unveiling the Young Central Stellar Disk in the Advanced	NIFS	8.0
GN-2012A-Q-18	Reynaldi	AR	Searching for evidence of jet-cloud interaction in radio-	GMOS-N	3.9
GN-2012A-Q-19	Perlmutter	US/UK/AU	Galaxy Cluster Supernovae at z~0.5: Dissecting the Hubble	GMOS-N	9.1
GN-2012A-Q-20	Paron	AR	Observing shocked gas towards the Young Stellar	NIRI	2.7
GN-2012A-Q-21	Muratore	AR	Disk kinematics of the A[e] supergiant HD 62623	GNIRS	0.3
GN-2012A-Q-22	McDermid	US/UK	Characterizing the Near-Infrared SEDs of Early-Type	GNIRS	9.0
GN-2012A-Q-23	Mason	BR	NIR spectroscopy of Palomar emission-line galaxies	GNIRS	8.0
GN-2012A-Q-24	Luhman	US	Confirmation of an Edge-on Disk around a Brown Dwarf	NIRI	0.6
GN-2012A-Q-25	Lucas	UK	A VISTA/Viking+WISE search for Y dwarfs and benchmark	GNIRS	4.2
GN-2012A-Q-26	Lidman	AU	Improving Type Ia supernovae as distance indicators	NIRI	2.0
GN-2012A-Q-27	Levan	UK/US	The late time behaviour of a relativsitic tidal disruption	NIRI	9.9
GN-2012A-Q-28	Koss	UH	Searching for AGN Activation in Close Mergers	GMOS-N	15.0
GN-2012A-Q-29	Kilic	US	Gravitational Waves from the 12 minute Orbital Period	GMOS-N	5.0
GN-2012A-Q-30	Kepler	US	Are all high mass white dwarf stars magnetic? A test via	GMOS-N	8.0
GN-2012A-Q-31	Kasliwal	US	Rapid Spectroscopy of Elusive Transients and Young	GMOS-N	4.5
GN-2012A-Q-32	Jha	US	Adding to the Treasury: Spectroscopic Classification of	GMOS-N	11.2
GN-2012A-Q-33	James	US	The True Abundances of Star-Forming Galaxies: Ionized Gas	GMOS-N	11.0
GN-2012A-Q-34	Howell	US/UK	Early-time observations of Type Ia supernovae to reveal	GMOS-N	20.0
GN-2012A-Q-35	Hirst	GS	Completion of the UKIDSS LAS search for z>6.5 quasars	GMOS-N	4.0
GN-2012A-Q-36	Grundy	US	Mutual Orbits and Masses of Kuiper Belt Binaries and	NIRI	12.5
GN-2012A-Q-37	Gizis	US	L Dwarf Variability: Clouds or Spots?	GMOS-N	9.0

GN-2012A-Q-38	Fraser	UK	Detecting the progenitors of core collapse supernovae -	NIRI	3.0
GN-2012A-Q-39	Fox	GS/US/AU/UK	Gamma-Ray Bursts: Progenitors, Physics, and	GNIRS	28.0
GN-2012A-Q-40	Fadely	US	Searching for Our Faintest Neighbors: Deep Imaging of	GMOS-N	12.6
GN-2012A-Q-41	Do	US	Determining the physical properties and dynamical	NIFS	15.0
GN-2012A-Q-42	Diniz	BR	The AGN-Starburst connection probed with	NIFS	4.8
GN-2012A-Q-43	Desert	US	Relative atmospheric compositions of a multiplanet	GMOS-N	8.0
GN-2012A-Q-44	Dell'Antonio	US	A Strong Lensing Measurement in the	GNIRS	7.0
GN-2012A-Q-45	Couch	AU	The Build-up of the Red Sequence in Galaxy Clusters	GMOS-N	8.2
GN-2012A-Q-46	Carrasco	Ge	An accurate estimation of the velocity dispersion of compact	NIFS	5.7
GN-2012A-Q-47	Canning	UK	The dynamics of the merging galaxy cluster Abell 2146	GMOS-N	13.5
GN-2012A-Q-48	Bowler	UH	Giant Planets Around Low-Mass Stars	NIFS	7.0
GN-2012A-Q-49	Bibby	UK	Classifying Wolf-Rayet stars in M101: A Complete Survey	GMOS-N	23.6

GN Scientific Ranking 2012A Band 2

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2012A-Q-50	Wainscoat	UH	Properties of new PS1 discoveries including Comet	GNIRS	11.5
GN-2012A-Q-51	Wahhaj	UH	High-contrast imaging and confirmation of candidate	NIRI	7.8
GN-2012A-Q-52	Verma	UK/CA	Physical properties of star-forming high-z galaxies	GNIRS	17.2
GN-2012A-Q-53	Trujillo	US	Water Ice on Outer Satellites of the Giant Planets	NIRI	5.0
GN-2012A-Q-54	Steeghs	UK	Fundamental parameters of newly discovered AM CVn	GMOS-N	6.6
GN-2012A-Q-55	Smith Castelli	AR	Exploring the faint galaxy content and the globular	GMOS-N	2.5
GN-2012A-Q-56	Ryder	AU	The Supernova Factories Arp 299 and IC 883	NIRI	5.8
GN-2012A-Q-57	Riffel	BR	The Co-Evolution of Supermassive Black Holes and	NIFS	16.1
GN-2012A-Q-58	Rich	UH	An Integral Field Study of U/LIRGs	GMOS-N	10.0
GN-2012A-Q-59	Phillips	US	Near-Infrared Spectroscopic Followup of Type Ia	GNIRS	10.0
GN-2012A-Q-60	Papovich	US/AU	H-alpha Narrow Band Imaging of a Forming Cluster at z=2.2	NIRI	17.5
GN-2012A-Q-61	Najarro	US/GS	Metallicity in the Quintuplet Cluster and the Galactic	GNIRS	11.0
GN-2012A-Q-62	McNamara	CA	After the show is over - the dynamics of line-emitting gas	GMOS-N	2.5
GN-2012A-Q-63	Luhman	US	Spectroscopy of a New T dwarf Companion to a Nearby	GNIRS	0.9
GN-2012A-Q-64	Kriek	US	Physical Properties of z$\sim$1.5 Galaxies as a	GNIRS	17.5
GN-2012A-Q-65	Kirkpatrick	US	Determining what drives outflows in high redshift	GNIRS	22.5
GN-2012A-Q-66	Kewley	UH	Intermediate Mass Black Holes and the Nature of Ambiguous	GMOS-N	4.0
GN-2012A-Q-67	Jonker	US	The unique opportunity to determine the mass of an	NIRI	2.0
GN-2012A-Q-68	Hsieh	UH	Characterization of the Active Behavior of Main-Belt Comets	GMOS-N	6.7
GN-2012A-Q-69	Hsiao	US	Late-time near-infrared spectroscopy of SN 2011fe	GNIRS	4.7
GN-2012A-Q-70	Hilton	UK	The Evolution of Galaxy Cluster Mass-Observable	GMOS-N	26.3
GN-2012A-Q-71	Heinke	CA	Testing the Ten-Minute Orbital Period of 4U 1728-34	NIRI	2.5
GN-2012A-Q-72	Heinke	CA	Infrared imaging and spectroscopy of transient	NIRI	11.6
GN-2012A-Q-73	Hagele	AR	The CNSF rings of Seyfert galaxies and their connection	GMOS-N	4.5
GN-2012A-Q-74	Grundy	US	Mutual Orbits and Masses of Kuiper Belt Binaries and	NIRI	12.5
GN-2012A-Q-75	Geballe	GS	Additional Probes of the Galactic Center's Interstellar	GNIRS	10.0
GN-2012A-Q-76	Fraser	CA	AO Observations of Quaoar-Weywot: Measuring the	NIRI	6.0
GN-2012A-Q-77	Dong	US	Isolated massive star formation in the Galactic	GNIRS	7.0
GN-2012A-Q-78	Cushing	US	Northern Hemisphere Follow-Up Observations of WISE	NIRI	24.1
GN-2012A-Q-79	Courteau	CA	Constraining the Disk Heating Mechanisms in Spiral Galaxies	GMOS-N	32.0
GN-2012A-Q-80	Couch	AU	The Build-up of the Red Sequence in Galaxy Clusters	GMOS-N	8.2
GN-2012A-Q-81	Cote	GS/US/CA/UK	The Origin of Low-Mass, Early-Type Galaxies: A	GMOS-N	34.3
GN-2012A-Q-82	Cieza	UH	Toward a complete census of circumstellar disks with	GMOS-N	17.5
GN-2012A-Q-83	Chiang	US	Young planetary objects in the ρ Ophiuchi dark cloud	GNIRS	15.0

GN-2012A-Q-84	Burningham	AU/GS/UK	Solving the late-T dwarf luminosity function	GNIRS	36.2
GN-2012A-Q-85	Berger	GS/US	Exotic Explosions and Eruptions: Exploring a New	GMOS-N	9.0
GN-2012A-Q-86	Banerji	UK	A Rare Population of Extremely Red Quasars from	GNIRS	3.4
GN-2012A-Q-87	Banerji	UK	A Rare Population of Extremely Red Quasars from	GNIRS	3.3
GN-2012A-Q-88	Allen	US	A Multi-Epoch Survey for Faint, Close, Low-Mass	NIRI	6.1
GN-2012A-Q-89	Aidelman	AR	Open clusters: physical properties and the angular	GMOS-N	3.7

GN Scientific Ranking 2012A Band 3

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2012A-Q-90	Trujillo	GS	Water Ice on Outer Satellites of the Giant Planets	NIRI	5.0
GN-2012A-Q-91	Sullivan	US/UK	The Host Galaxies of Local PTF Type Ia Supernovae	GMOS-N	44.3
GN-2012A-Q-92	Strauss	US	Rest-Frame Optical Spectra of High-Redshift Obscured	GNIRS	15.0
GN-2012A-Q-93	Straka	UH	"3-D" Mapping of Star Formation and Kinematics in	NIFS	8.5
GN-2012A-Q-94	Stocke	US	Highly Obscured Radio-Loud Quasars	GMOS-N	15.0
GN-2012A-Q-95	Sonnett	UH	Surface Properties of Trans-Neptunian Misfits	NIRI	8.4
GN-2012A-Q-96	Schechtman-Rook	US	Stellar Populations in Edge-on Spiral Disks	GNIRS	8.0
GN-2012A-Q-97	Sato	CA	Gas Inflows in Red-sequence Galaxies	GMOS-N	25.5
GN-2012A-Q-98	Rhee	GS	Stable Carbon Isotope Ratios for Giant Stars in the Globular	GNIRS	9.0
GN-2012A-Q-99	Quinn	US	Close visual companions to transiting exoplanet host	NIRI	15.0
GN-2012A-Q-100	O'Toole	AU	GMOS Follow up of MUCHFUSS candidate systems - northern	GMOS-N	6.6
GN-2012A-Q-101	Micheli	UH	Connections between NEOs and meteoroid streams	GMOS-N	2.5
GN-2012A-Q-102	Mendes de Oliveira	BR	NGC 2782: a merger remnant with inverted metallicity	GMOS-N	6.4
GN-2012A-Q-103	McDermid	UK/CA/GS	Identifying old Tidal Dwarf Galaxies around nearby	GMOS-N	15.0
GN-2012A-Q-104	Mason	US	NIR spectroscopy of Palomar emission-line galaxies	GNIRS	19.0
GN-2012A-Q-105	Lena	US	Mapping sub-kiloparsec gas flows in nearby AGN	GMOS-N	7.0
GN-2012A-Q-106	Leggett	Ge	Far-Red/Infrared Photometry of Proposed Y Dwarfs	GMOS-N	6.2
GN-2012A-Q-107	Leao	BR	Color maps of the R CrB prototype in mid-infrared	NIRI	5.0
GN-2012A-Q-108	Kepler	AR/US	The Most Massive Pulsating White Dwarf Stars	GMOS-N	14.0
GN-2012A-Q-109	Kepler	BR	Are all high mass white dwarf stars magnetic? A test via	GMOS-N	3.2
GN-2012A-Q-110	Keeney	US	Gas and Galaxies in the Cosmic Web: II. Associations	GMOS-N	23.0
GN-2012A-Q-111	Hsieh	US	Searching for High Velocity Jets in DCE185 - The Only	NIRI	0.5
GN-2012A-Q-112	Hsieh	UH	The Sublimation-Driven Nature of Main-Belt Comet	GMOS-N	7.0
GN-2012A-Q-113	Heinke	CA	Investigating the nature of transient sub-luminous X-ray	NIRI	11.9
GN-2012A-Q-114	Heinke	CA	The Nature of Two Fast X-ray Transients	GNIRS	2.8
GN-2012A-Q-115	Fraser	UK	SN 2011dh - understanding the progenitor properties	GNIRS	7.9
GN-2012A-Q-116	Brittain	US	HI emission lines on young stars: accretion or ejection	NIFS	10.5
GN-2012A-Q-117	Bremer	UK	Exploring early cluster evolution with SMGs	GMOS-N	27.5
GN-2012A-Q-118	Bentz	AU/US	A Stellar Dynamical Black Hole Mass for the Reverberation-	NIFS	20.0
GN-2012A-Q-119	Aspin	UH	ToO Observations of Recently and Newly Discovered Young	NIRI	12.0

GN Scientific Ranking 2012A Band 4

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GN-2012A-Q-120	Mason	GS	NIR spectroscopy of Palomar emission-line galaxies	GNIRS	14.5
GN-2012A-Q-121	Geballe	US	Additional Probes of the Galactic Center's Interstellar	GNIRS	40.0

GS Scientific Ranking 2012A Classical and Band 1

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GS-2012A-C-1	Menanteau	US/CL	Mass Calibration of a Sample of ACT SZE-Selected Galaxy	GMOS-S	30
GS-2012A-C-2	Bunker	UK	HST/WFC3-Grism Emission-Line Selected Galaxies - Ultra	GMOS-S	30
GS-2012A-C-3	Honda	Subaru	Observations of Water Ice Distribution in the Disk	NICI	20
GS-2012A-C-4	Onaka	Subaru	T-ReCS Observations of the Remarkable Mid-Infrared	T-ReCS	20
GS-2012A-C-5	Sakon	Subaru	Chemical and Mineralogical Evolution of Dust around Nova	T-ReCS	10
GS-2012A-Q-1	Vasquez	AR	Mid-IR observations towards the EGO G049.27-0.34	T-ReCS	2.8
GS-2012A-Q-2	Tinney	AU	Imaging Anglo-Australian Planet Search companions	NICI	8.0
GS-2012A-Q-3	Sullivan	UK	The Host Galaxies of Local PTF Type Ia Supernovae	GMOS-S	4.5
GS-2012A-Q-4	Stubbs	US	Spectroscopy of Galaxies in Massive Clusters: \\ Galaxy	GMOS-S	23.7
GS-2012A-Q-5	Smartt	UK	Ultrabight optical transients : giant supernova in dwarf	GMOS-S	10.0
GS-2012A-Q-6	Salinas	CL	The globular cluster systems of isolated elliptical galaxies	GMOS-S	10.7
GS-2012A-Q-7	Sales	BR	On the Nature and Distribution of Dusty Material	T-ReCS	11.4
GS-2012A-Q-8	Sahu	US	Discovery of Isolated Black Holes and Neutron Stars	GMOS-S	21.0
GS-2012A-Q-9	Rapoport	AU	Testing the Strong Gravitational Lensing	GMOS-S	3.4
GS-2012A-Q-10	Onken	AU	Australia's 2012 Gemini School Astronomy Contest	GMOS-S	1.0
GS-2012A-Q-11	Naud	US	A Planet Search around Young-associations M dwarfs	NICI	3.0
GS-2012A-Q-12	Myers	US	Characterizing the Circumgalactic Medium of	GMOS-S	20.0
GS-2012A-Q-13	Metchev	US	A Sensitive Search for Exozodi Across the Ten-Micron Silicate	T-ReCS	21.0
GS-2012A-Q-14	McConnell	US	A Southern Hemisphere Survey of Black Holes	GMOS-S	18.0
GS-2012A-Q-15	Keller	AU	Intermediate age star clusters of the LMC - missing links in	GMOS-S	2.1
GS-2012A-Q-16	Kasliwal	US	Rapid Spectroscopy of Elusive Transients and Young	GMOS-S	4.5
GS-2012A-Q-17	Jha	US	Adding to the Treasury: Spectroscopic Classification of	GMOS-S	11.2
GS-2012A-Q-18	Janson	CA/US	Follow-up of young planet and brown dwarf candidates	NICI	11.0
GS-2012A-Q-19	Hsieh	US	The Sublimation-Driven Nature of Main-Belt Comet	GMOS-S	6.0
GS-2012A-Q-20	Howell	UK/US	Early-time observations of Type Ia supernovae to reveal	GMOS-S	10.0
GS-2012A-Q-21	Harrison	UK	How common are galaxy-wide AGN-driven outflows?	GMOS-S	22.1
GS-2012A-Q-22	Grise	US	A direct test on the nature of the optical emission in an	GMOS-S	6.7
GS-2012A-Q-23	Garcia	AR	Brown dwarf or planetary mass companions of debris	NICI	3.3
GS-2012A-Q-24	de Mooij	CA	Optical thermal emission spectrum of WASP-19b, the	GMOS-S	16.0
GS-2012A-Q-25	Cucchiara	GS/US/UK/AU/CL	Exceptional Swift and Fermi GRBs: Gemini South Rapid	GMOS-S	16.0
GS-2012A-Q-26	Cobb	GS/UK/US	Late-time Observations of Exceptional Swift and Fermi	GMOS-S	5.0
GS-2012A-Q-27	Chhetri	AU	Search for Gravitational Lenses in the Southern	GMOS-S	2.9
GS-2012A-Q-28	casassus	CL	Planet search in gas-rich transition disks	NICI	7.0
GS-2012A-Q-29	Cami	CA	Revealing Fullerene Excitation and Formation	T-ReCS	14.0
GS-2012A-Q-30	Bersier	UK	The Supernovae of Gamma-Ray Bursts: Exploring the	GMOS-S	6.0
GS-2012A-Q-31	Berger	GS/US	Exotic Explosions and Eruptions: Exploring a New	GMOS-S	9.0

GS Scientific Ranking 2012A Band 2

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GS-2012A-Q-32	Young	UK	The Jet-Cloud Interaction of PKS B2152-699	GMOS-S	12.4
GS-2012A-Q-33	Tobin	US	Probing the Youngest Proto-Planetary Disks: Mid-Infrared	T-ReCS	0.4
GS-2012A-Q-34	Tejos	US/UK	Gas and Galaxies in the Cosmic Web	GMOS-S	13.9
GS-2012A-Q-35	Tejos	US/UK	Gas around Galaxies over the last 7 billion years	GMOS-S	7.8
GS-2012A-Q-36	Subasavage	GS	Mapping the Orbits of Two Double Degenerate	GMOS-S	4.0
GS-2012A-Q-37	Stubbs	US	Spectroscopy of Galaxies in Massive Clusters: \\ Galaxy	GMOS-S	14.6
GS-2012A-Q-38	Rapoport	AU	Investigating GRB-SN connection for real GRBs	GMOS-S	13.2
GS-2012A-Q-39	Puzia	CL	The Total Mass of Virgo Cluster Dwarfs as traced by	GMOS-S	18.9

GS-2012A-Q-40	Neichel	GS	Pipelines on the Periphery: A Search for Gas Flows in the	GMOS-S	8.0
GS-2012A-Q-41	Melis	US	The Amazing Disappearing Disk	T-ReCS	0.2
GS-2012A-Q-42	Lima Neto	BR	Deep imaging and spectroscopy of a massive	GMOS-S	8.0
GS-2012A-Q-43	Levenson	GS	A Complete AGN Sample to Test Unification	T-ReCS	14.0
GS-2012A-Q-44	Jonker	US	Completing the Galactic Bulge Survey: categorizing the	GMOS-S	15.0
GS-2012A-Q-45	Hinkle	US	Imaging the debris cloud around the final flash star	NICI	1.0
GS-2012A-Q-46	Hilton	BR/UK	The Evolution of Galaxy Cluster Mass-Observable	GMOS-S	40.0
GS-2012A-Q-47	Heinke	CA	Testing the Twenty-Minute Orbital Period of 4U 1850-	GMOS-S	4.3
GS-2012A-Q-48	Hagele	AR	The CNSF rings of Seyfert galaxies and their connection	GMOS-S	6.0
GS-2012A-Q-49	Foley	US	The Most Precise Distances to Type Ia Supernovae	GMOS-S	13.5
GS-2012A-Q-50	Drake	US	Supernovae in Extreme Environments	GMOS-S	9.0
GS-2012A-Q-51	Cote	CA/UK/GS	The Origin of Low-Mass, Early-Type Galaxies: A	GMOS-S	14.6
GS-2012A-Q-52	Bussmann	UK/US	Longslit Spectroscopy of Lensing Galaxies Discovered	GMOS-S	15.6
GS-2012A-Q-53	Bowler	US	An Efficient Search for Young Wide Planetary-Mass	NICI	22.0
GS-2012A-Q-54	Bai	CA	The zRCS Deep Group Survey	GMOS-S	35.0
GS-2012A-Q-55	Anguita	CL	Velocity dispersions and stellar populations of RCS2	GMOS-S	6.0
GS-2012A-Q-56	Aller	US	A Multi-Wavelength Optical Imaging Study of a Unique	GMOS-S	16.1

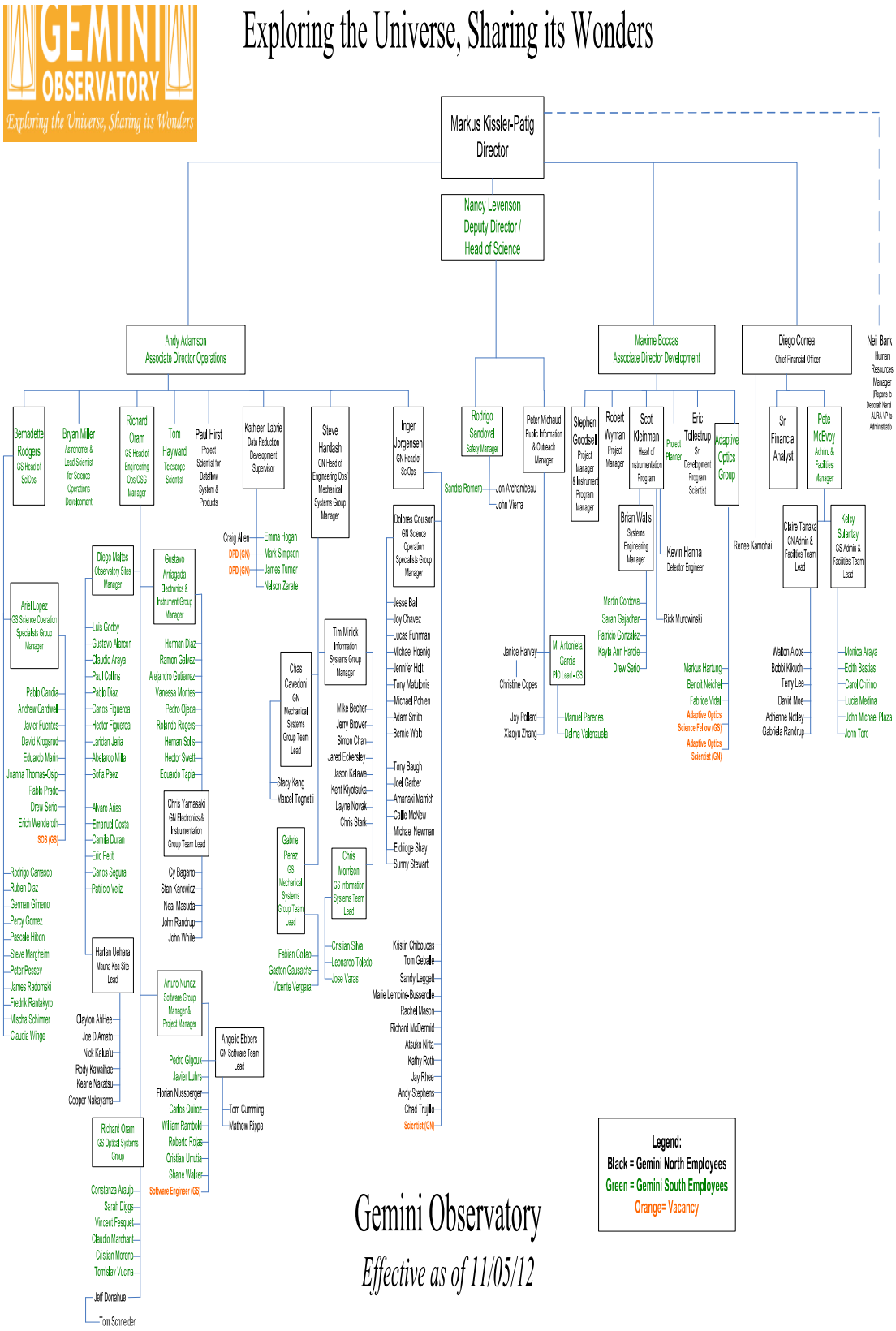
GS Scientific Ranking 2012A Band 3

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GS-2012A-Q-57	Zepf	US	A Search for Optical Emission Lines from the Globular	GMOS-S	6.0
GS-2012A-Q-58	Yong	AU	Metallicity dispersions in the Galaxy's most massive	GMOS-S	6.0
GS-2012A-Q-59	Vaduvescu	AR/UK/CL	The ABC of BCDs: Antlia Cluster	GMOS-S	12.6
GS-2012A-Q-60	Telesco	US	Mid-IR Exploration of an Edge-On Protoplanetary Disk	T-ReCS	2.7
GS-2012A-Q-61	Rebassa-Mansergas	CL	Searching for close double white dwarfs in the Sloan	GMOS-S	7.5
GS-2012A-Q-62	O'Toole	AU	GMOS Follow up of MUCHFUSS candidate systems - southern	GMOS-S	6.6
GS-2012A-Q-63	Modjaz	US	Host Galaxy Spectra of Stripped SN from the Palomar	GMOS-S	6.0
GS-2012A-Q-64	Milisavljevic	US	Resolving SN Ejecta Asymmetries with High-	GMOS-S	3.6
GS-2012A-Q-65	Li	US	Probing the protoplanetary disk of TW Hya with T-ReCS	T-ReCS	3.2
GS-2012A-Q-66	Kong	US	Spectroscopic confirmation of a compact binary system	GMOS-S	1.0
GS-2012A-Q-67	Jonker	US	Completing the Galactic Bulge Survey: categorizing the	GMOS-S	15.0
GS-2012A-Q-68	Hilton	BR	The Evolution of Galaxy Cluster Mass-Observable	GMOS-S	5.1
GS-2012A-Q-69	Hillwig	UK	Determining the System Parameters for Poorly Studied	GMOS-S	10.0
GS-2012A-Q-70	Haggard	US	X-ray Binary Candidates Along Omega Centauri's	GMOS-S	31.0
GS-2012A-Q-71	Hagele	GS	The CNSF rings of Seyfert galaxies and their connection	GMOS-S	6.0
GS-2012A-Q-72	Gimeno	GS	Stellar kinematics of interacting galaxies in	GMOS-S	8.0
GS-2012A-Q-73	Clayton	US	The Natural Coronographs of R Coronae Borealis Stars	GMOS-S	2.9
GS-2012A-Q-74	Calderon	AR	Spectroscopy of faint extended and compact stellar	GMOS-S	5.0
GS-2012A-Q-75	Bremer	UK	Exploring the early evolution of a cluster around an SMG	GMOS-S	24.8
GS-2012A-Q-76	Beers	BR	A Survey for Unrecognized Carbon-Enhanced Metal-Poor	GMOS-S	6.0
GS-2012A-Q-77	Bartlett	US	Planck SZ Clusters: Follow-up of the Planck Galaxy Cluster	GMOS-S	35.0
GS-2012A-Q-78	Artigau	CA	PSYM-wide: a search for wide-separation planetary	GMOS-S	22.2
GS-2012A-Q-79	Andrews	US	Dust Formation and Circumstellar Medium	GMOS-S	8.7

GS Scientific Ranking 2012A Band 4

Gemini ID	PI Name	Partners	Title	Instrument	Hours
GS-2012A-Q-81	Beers	BR/US	A Survey for Unrecognized Carbon-Enhanced Metal-Poor	GMOS-S	74.0

Appendix E. Organizational Chart



Appendix F. Acronyms and Abbreviations

A&G	Acquisition and Guiding
A&G-2	Acquisition and Guiding, second generation
AJ	Astronomical Journal
Altair	Altitude Conjugated Adaptive Optics for Infrared
AO	Adaptive Optics
ApJ	Astrophysical Journal
ASM	Adaptive Secondary Mirror
AURA	Association of Universities for Research in Astronomy, Inc.
CAS	(AURA) Centralized Administrative Services
CC	Cloud Cover
CCD	Charge-Coupled Device
CFHT	Canada-France-Hawaii Telescope
CP	Cerro Pachón
DSSI	Differential Speckle Survey Instrument
ESPaDOnS	Echelle Spectro-Polarimetric Device for the Observation of Stars
FDF	Facilities Development Fund
FITS	Flexible Image Transport System
FLAMINGOS-2	Florida Multi-Object Infrared Grism Observing Spectrograph-2
FTE	Full-Time Equivalent
GCAL	Gemini Facility Calibration Unit
GeMS	Gemini Multi-Conjugate Adaptive Optics System
GHOS	Gemini High-Resolution Optical Spectrograph
GMOS	Gemini Multi-Object Spectrograph
GMOS-N	Gemini Multi-Object Spectrograph-North
GMOS-S	Gemini Multi-Object Spectrograph-South
GN	Gemini North
GNAO	Gemini North Adaptive Optics
GNIRS	Gemini Near-Infrared Spectrograph
GPI	Gemini Planet Imager
GRACES	Gemini Remote Access to Canada-France-Hawaii ESPaDOnS Spectrograph
GS	Gemini South (or Gemini Staff, only in time allocation listing)
GSA	Gemini Science Archive
GSAOI	Gemini South Adaptive Optics Imager
GUI	Graphical User Interface
HIA	Herzberg Institute of Astrophysics
IDF	Instrument Development Fund
IR	Infrared
ITAC	International Time Allocation Committee
LGS	Laser Guide Star
LGS+P1	Laser Guide Star + Peripheral Wavefront Sensor 1
MCAO	Multi-Conjugate Adaptive Optics
MK	Mauna Kea
MNRAS	Monthly Notices of the Royal Astronomical Society
NGO	National Gemini Office
NGSWFS	Natural Guide Star Wavefront Sensor
NICI	Near-Infrared Coronagraphic Imager
NIFS	Near-Infrared Integral Field Spectrometer
NIR	Near-infrared
NIRI	Near Infrared Imager and Spectrometer

NOAO-S	(US) National Optical Astronomy Observatory-South
NSF	(US) National Science Foundation
O&M	Operations and Maintenance
OCS	Observatory Control Systems
Ops	Operations
PASP	Publications of the Astronomical Society of the Pacific
PDF	Portable Document Format
PI	Principal Investigator
PIO	Public Information and Outreach
Q1	Quarter 1
QA	Quality Assessment
RA	Right Ascension
SBF	Southern Base Facility
SOS	Science Operations Specialist
SPEC	Special grants and awards fund
STAC	Science and Technology Advisory Committee
sub-mm	sub-millimeter
TAC	Time Allocation Committee
T-ReCS	Thermal-Region Camera Spectrograph
UCG	Users' Committee for Gemini
UK	United Kingdom
US	United States
z	redshift