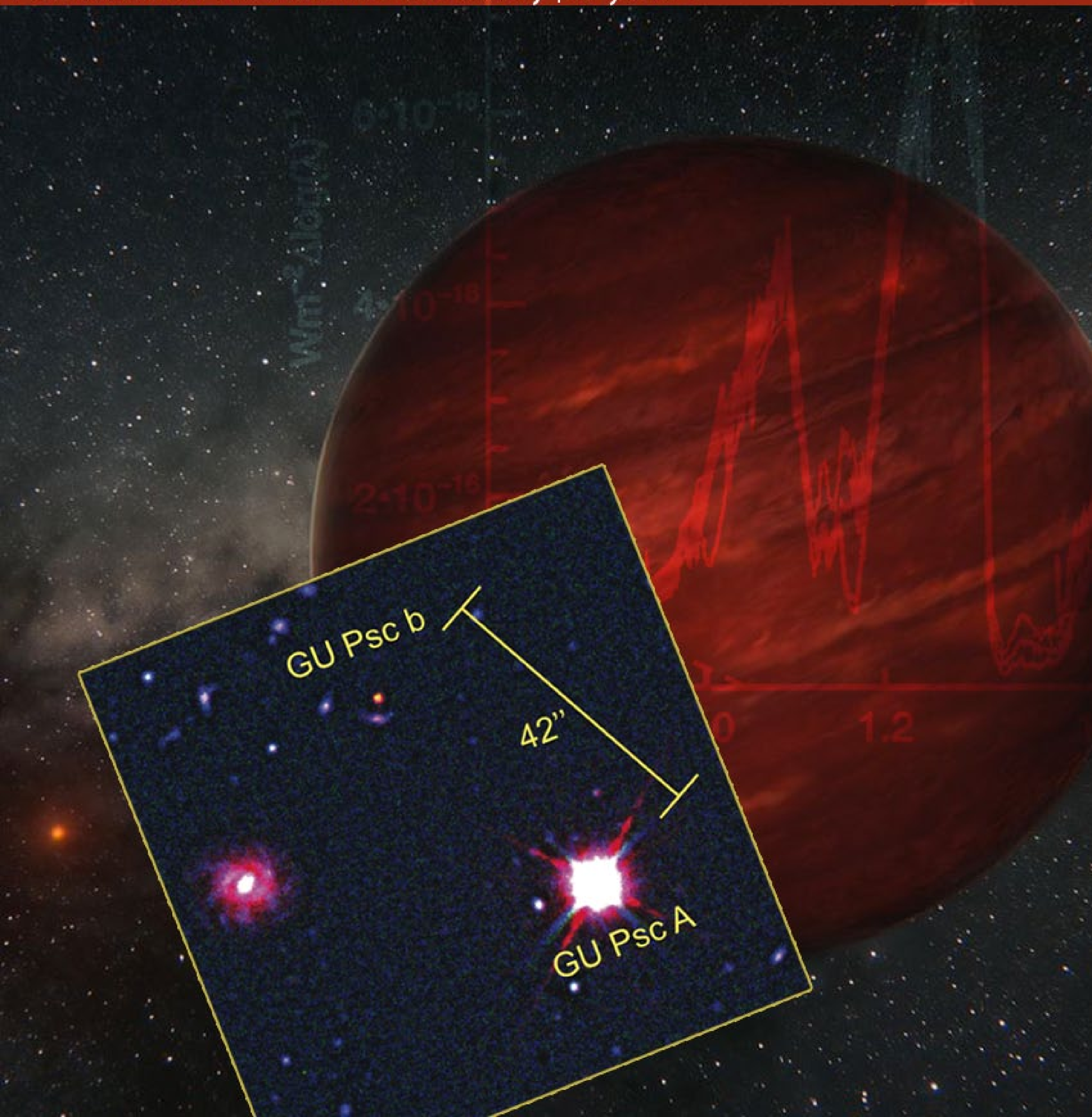
GeminiFocus

Publication of the Gemini Observatory | July 2014



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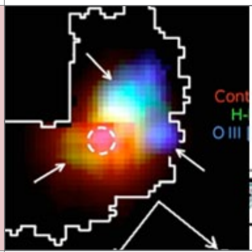
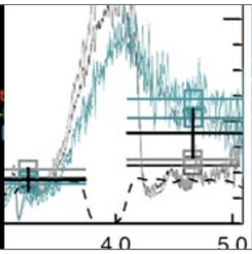


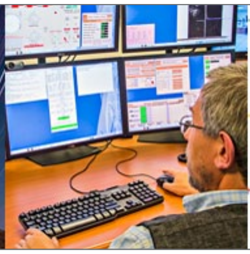
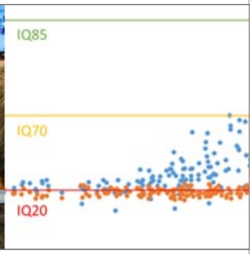

ON THE COVER:

Data (inset) and artwork (background) from this issue's feature story on the widely separated star (GU Psc A) and planet (GU Psc b). See the story starting on page 3 of this issue.

Gemini*Focus July 2014*

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Markus Kissler-Patig

Director's Message

A New Instrument Procurement Model for Gemini, and More!

It's mid-2014 and the Gemini Observatory is now halfway through its transition phase to a ~25 percent reduction in contributions from our partner countries. The good news is that we are on track to run the Observatory sustainably on a significantly lower operations budget. Accomplishing this continues to require hard work and savings across the Observatory, as well as some reduced services to our users. However, we are confident that Gemini will remain as attractive, if not more so in the future, thanks to innovative ideas in operations and instrumentation.

One of the latest areas of significant progress is in instrumentation. A working group — including Gemini members, the National Science Foundation, Gemini's Science and Technology Advisory Committee (STAC), the Association of Universities for Research in Astronomy's Oversight Committee, and the Gemini Board — defined a new instrument procurement model. The Board endorsed it during their recent meeting in May.

In a nutshell: Adding instruments to Gemini's suite will now be easier and more flexible.

The still valid classical avenue for instrument development consists of the Observatory requesting proposals for a facility-class instrument and fully funding it. We added, two years ago, the "visiting instrument path" (*available here*) for fast, uncomplicated (but limited) access to the telescope.

These strategies are now complemented by several others. Partner and non-partner countries alike can now deliver facility-class instruments as in-kind contributions to the Observatory in return for telescope time. These instruments must be approved by the STAC, but this new plan allows individual groups or communities to deliver their priority instrument to the Observatory, rather than to rely on a consensus selection across Gemini's large user base.

Consortia responding to instrument requests from the Observatory are no longer bound to the Observatory's available budget, but can be compensated with telescope time for any cash or in-kind contributions. Finally, the decision and procurement paths were simplified to avoid the significant overhead often created by Gemini's complicated governance structure.

Overall, we hope that these changes will encourage many instrumentation groups across Gemini's large and diverse partnership and beyond to engage in instrument building for the Observatory in win-win partnerships (for more details on how this process is being applied now, see the update on page 18 of this issue on the Gen4#3 instrument procurement currently underway).

New Operational Modes Too

On the operations side, the new Large and Long Programs mode has resulted in the selection of seven programs that made it through the heavily oversubscribed process (the new mode saw an oversubscription factor of nearly six!) We look forward to welcoming the first observers for these programs, which, by default, will be carried out in the new "visitor priority observing" mode (available). In this mode, classical observers visit for longer periods than they have time allocated for their programs and are able to choose when to optimally observe their targets.

All observers should not forget that we endeavor to increase the use of Gemini to train and motivate young researchers. To this end, we also now offer the "bring-one, get-one (almost) free" plan; subsidizing, with $2000, for each observing visit of a student accompanying a more experienced classical observer (available here).

Finally, while we eagerly await the first results from a very successful early science run with the Gemini Planet Imager — 13 short programs were observed in April (available); you don't want to miss this issue's science feature article where a Canadian team, led by Maire-Ève Naud, used more conventional techniques to detect a planet some 2000 astronomical units from its host star!

With that, I'm looking forward to many more exciting science results from Gemini in 2014!

Markus Kissler-Patig is Gemini's Director. He can be reached at: mkissler@gemini.edu

 

Marie-Eve Naud and Étienne Artigau

GU Psc b: An Unexpected Planetary-mass Companion Discovered with GMOS

Capturing the faint light of an exoplanet near the blinding glow of its host star is a daunting task. It usually requires adaptive optics observations with specifically designed instruments and an arsenal of high-contrast imaging strategies. Our discovery of a giant exoplanet with the Gemini Multi-Object Spectrograph (GMOS) at Gemini South, however, shows that some planets might be much easier to find through "standard" imaging techniques.

In 2008, the direct detection (by Gemini) of a planet around 1RXS 1609-2105 and four alien planets around the distant star HR 8799 (by Gemini and the W.M. Keck observatories) paved the road to a new era of direct imaging exoplanet discoveries. Since then, a few other planets have joined the still short list of new worlds imaged, including β Pictoris b, GJ 504 b, and HD 95086 b.

There is high hope that the Gemini Planet Imager (GPI) and other new dedicated high-contrast imaging instruments will add many more objects to that list in the coming years. The amazing sophistication of these instruments, however, is testament to how difficult it remains to detect even the most massive exoplanets through direct imaging.

A Planet Where There Shouldn't Be

Our team, which includes researchers from Université de Montréal and international collaborators, just announced the discovery of a new exoplanet, GU Psc b. This planet, with

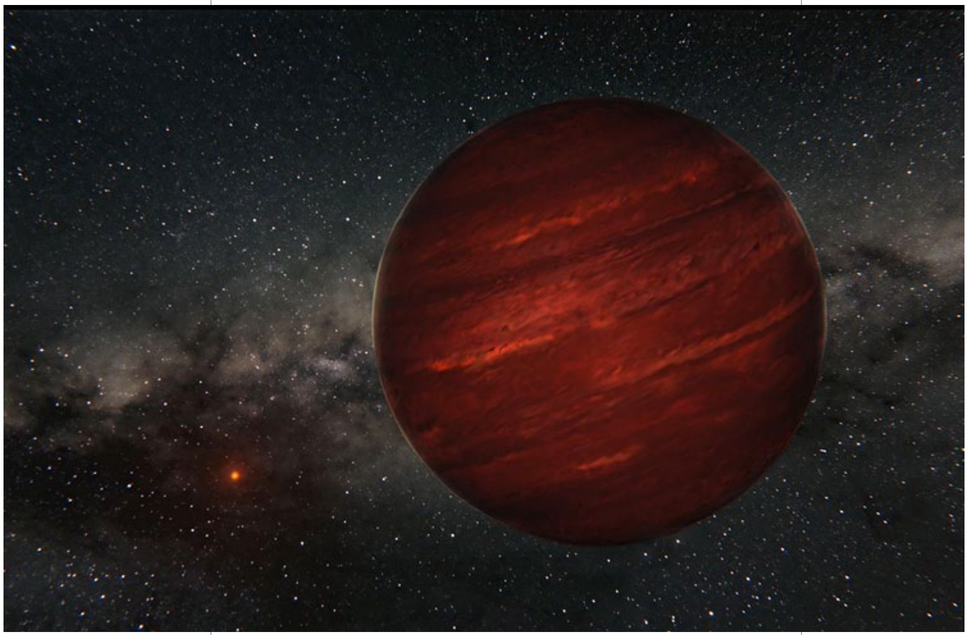

Figure 1.
Artist's concept of GU Psc b (foreground) and its distant host star. Illustration by Lucas Granito

a mass ~11 times that of Jupiter, was found through a survey carried out at Gemini South with the Gemini Multi-Object Spectrograph (GMOS) — without adaptive optics (AO) observations, nor with any sophisticated high-contrast instrument or special image analysis method.

Location, Location, Location

How then could we detect GU Psc b? Location. The key is that the planet is located very far from its host — 42 arcseconds, to be more precise, which translates to 2000 astronomical units (AU; the average distance of the Earth from the Sun), at its distance of about 48 parsecs (pc) or 157 light-years.

One reason we haven't found this world before is simply because we were not searching for planets orbiting that far from stars; probably because an anthropocentric bias motivates us to search for exoplanets where we find giant planets in our own Solar System. Also, from a theoretical point of view, current mainstream formation theories for exoplanets (core accretion, disk instability) simply do not predict giant worlds to be that far from their hosts. We discovered just the opposite.

As a complement to a survey we were carrying out with Gemini's Near-Infrared Coronographic Imager (NICI) to find planetary-mass companions to young, low-mass stars, we stepped outside the box. We decided to use GMOS to verify if really massive planets — much more massive than Jupiter — exist in the most distant realms of stellar systems.

Our survey, sensitive to objects with masses ranging from 5-7 Jupiter masses, was based on a very simple fact: that the Spectral Energy Distribution (SED) of very cool, planetary-mass objects displays a notable brightening from the red to the infrared. Therefore, we decided to take two images of the target star: one with an i filter, and the other with a z filter; cool objects could then be identified via their distinctively red i - z color.

A Newly Identified Young Star

The star sample made with NICI and GMOS at Gemini was one key to the survey's success, because the environments around young stars are ideal places to find planets through direct imaging. These worlds are still contracting and appear brighter at infrared wavelengths.

During her Ph.D. work at Université de Montréal, our colleague Lison Malo (now resident astronomer at Canada-France-Hawaii Telescope (CFHT)) developed, with René Doyon and David Lafrenière, a novel Bayesian analysis that also proved beneficial to our survey. It identifies new members of young associations based on the kinematic and photometric characteristics of the plausible candidates.

The Bayesian analysis revealed GU Psc A, an M3 star, to have a high probability of belonging to the 70-130 million-year-old AB Doradus Moving Group (ABDMG). The radial velocity estimated by the analysis agrees with the value we measured on our optical and near-infrared (NIR) spectra, which further confirm the membership. These radial-velocity data were obtained with the Phoenix spectrometer at Gemini South, CRIRES at the VLT, and ESPaDOnS at CFHT.

The star's X-ray luminosity is also consistent with that of ABDMG members. Furthermore, the many youth indicators we studied all agreed with GU Psc A being part of the ABDMG. A parallax measurement, ongoing through the Cerro Tololo Inter-American Observatory Parallax Investigation project, will allow reinforcing this membership even further. Meanwhile, as mentioned, we have adopted a distance of 48 ± 5 pc, for the star, as estimated by the Bayesian analysis.

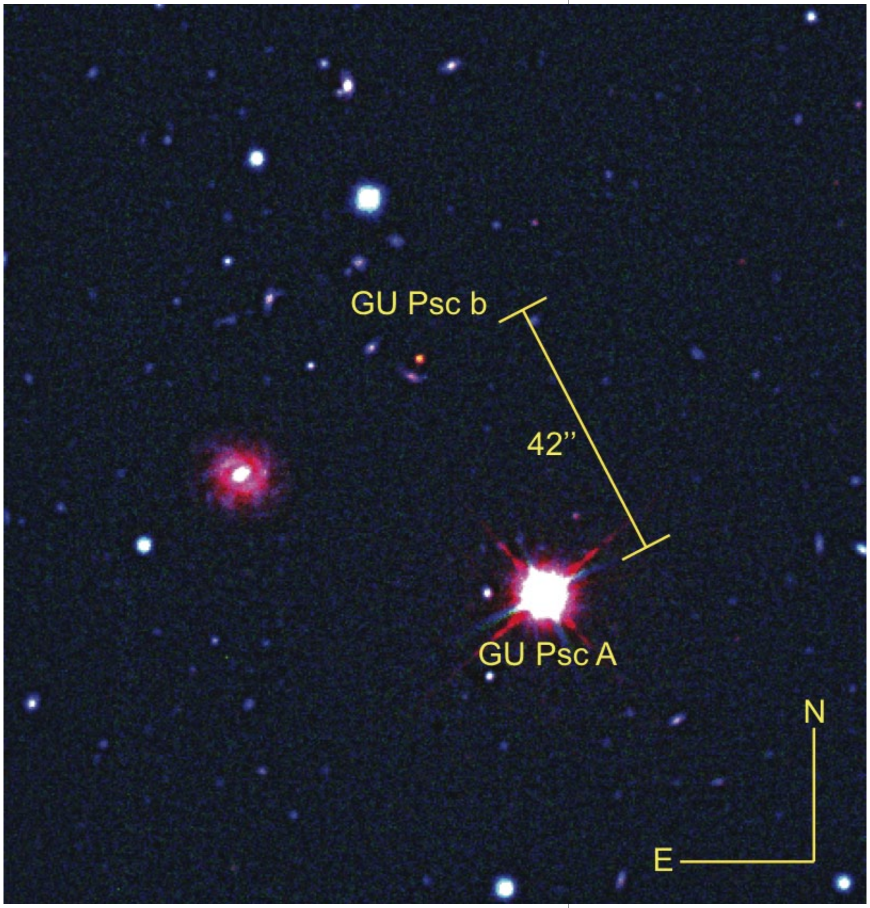

Figure 2.
Composite image of GU Psc b and its host star. The i (blue) and z (green) discovery observations from GMOS on Gemini South are shown with the follow-up J-band (red) image taken at CFHT.

GU Psc b: A Peculiar System?

As expected for a cool, planetary-mass object, GU Psc b was detected in the GMOS z observations. It is so faint in the optical, however, that the planet remained undetected in i band in a deep follow-up observation with GMOS. These results suggest a very red, i - z > 3.5, a color that is typical to a young planetary-mass object (and also ultracool field brown dwarfs and high-redshift quasars). GU Psc b was the only such object detected among the 90 stars surveyed with GMOS.

Follow-up observations were obtained with NIR cameras at Observatoire du Mont-Mégantic (CPAPIR) and at CFHT (WIRCam). Two sets of WIRCam J-band observations, spaced one year apart, allowed us to measure the proper motion of GU Psc b and to show that the suspected planet was indeed co-moving with GU Psc A. The Wide-field Infrared Survey Explorer (WISE) also observed GU Psc's field in the mid-infrared. All these photometric observations confirmed we had a planetary-mass companion; they were also of great use to calibrate the NIR spectrum, subsequently obtained at Gemini North using the Gemini Near-Infrared Spectrograph (GNIRS).

A comparison of the GNIRS spectrum both with standard objects and two models — a "Low-temperature cloud" atmosphere model provided by Caroline Morley and Didier Saumon (University of California Santa Cruz and Los Alamos National Laboratory), and a "BT-Settl" model by France Allard and Derek Homeier (Centre de Recherche Astrophysique de Lyon) — yielded precious information, including the spectral type (T3.5 ± 1) and a temperature between 1000-1100 K. In addition, the comparison showed indicators of low surface gravity (mainly the very strong K band), which is, compatible with the star's young age.

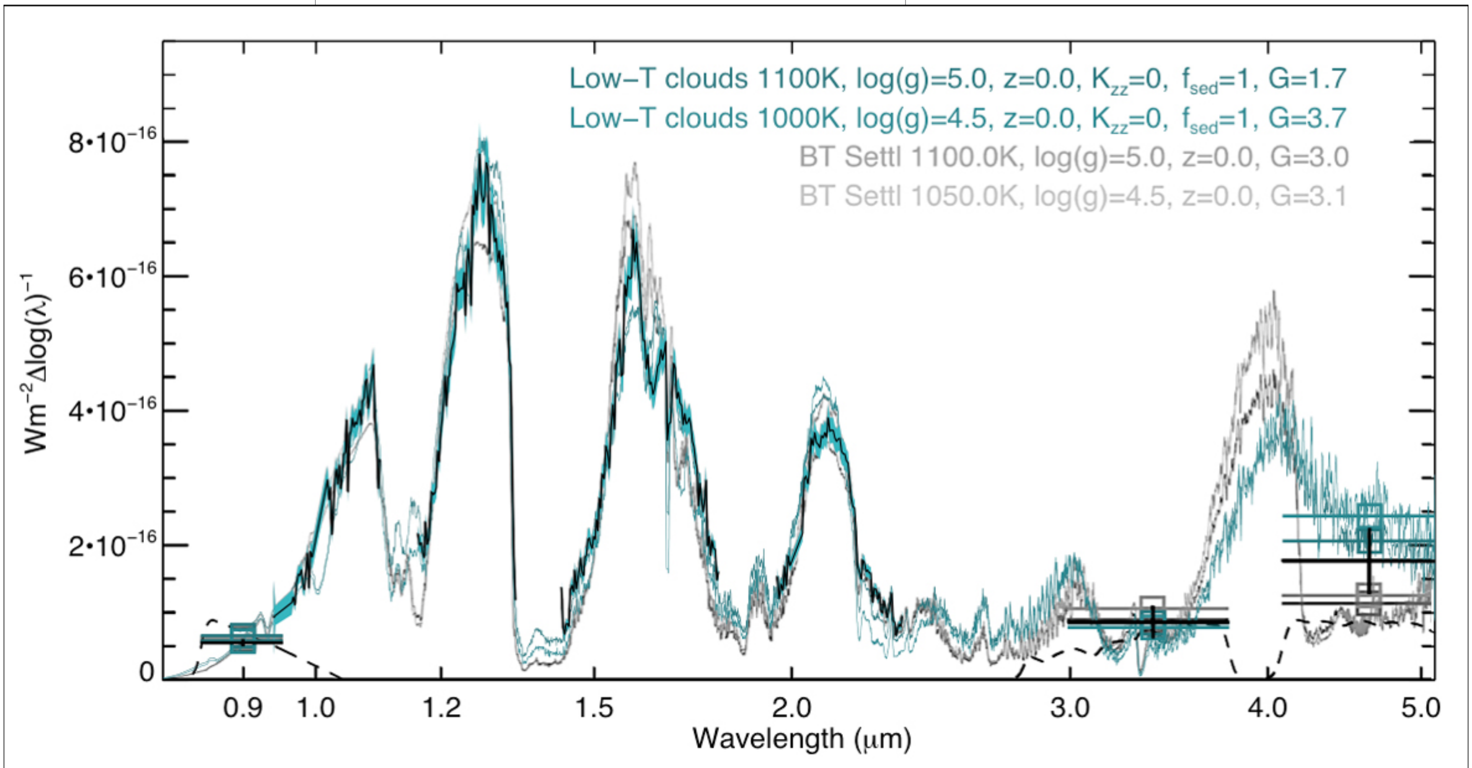

Figure 3.
The spectrum of GU Psc b, obtained at Gemini North with GNIRS, along with the GMOS z (~ 0.9 μm) and WISE W1 (~ 3.4 μm) and W2 (4.6 μm) photometric points. Also shown are the best-fitting, low-temperature cloud models of Morley et al.*, 2012, and the BT-Settl models of Allard* et al.*, 2012.*

The spectrum also revealed a few clues hinting that the companion itself might indeed be a binary object. First, it is quite similar to the spectrum of J1021-0304, a known brown dwarf binary (T1/T5). Second, the spectrum shows an over-luminosity around 1.6 microns in the H band — a region usually already over-luminous, as modelers like Saumon and others have previously noticed.

These tentative indications encouraged us to obtain, through collaborators Christopher Gelino and Charles Beichman (both Caltech NExScI), high-resolution H and K observations with the Laser Guide Star Adaptive Optics system and the near-infrared camera NIRC2 at Keck II. These reveal only one point source, which constrains strongly the eventual binarity of GU Psc b; namely, we can exclude the presence of a companion brighter than a typical T7-T8 down to about 2 AU.

To evaluate GU Psc b's physical properties, we used two evolutionary models: one by I. Baraffe *et. al.,* 2003; and the other by Saumon and M. Marley, 2008. We determined its luminosity using observed SED and atmospheric models. The results suggest a mass between 9 and 13 Jupiters at the age of AB-DMG (70-130 million years; Myr).

Many Questions, Many Answers, Some Mysteries

The very large distance between this planetary-mass companion and its host star raises many questions. For instance, how could such a massive companion end up so far from GU Psc A after ~100 Myr? It certainly seems unlikely that GU Psc b formed "as a planet," — *i.e.* in the protoplanetary disk surrounding the star, through either core accretion or disk instability.

Could this world be in the process of being ejected? Maybe, but we know of other supposedly gravitationally bounded systems that have similar binding energies (ratio of the masses of star and companion over the distance between the two).

Most likely, GU Psc A and its companion formed in the fragmentation of a collapsing molecular cloud, similar to the way a binary star system forms. In that case, even if GU Psc b is in all likelihood below 13 Jupiter masses, and thus of "planetary mass," we can wonder if it should be called a "planet."

At this point, it's hard to exclude other exotic scenarios, such as the capture by the current host star of a free-floating planet, formed on its own, or ejected from another star system. The host star and its companion could also have been ejected from the system of a more massive star. On various fronts, this object raises many questions.

A Key to Understanding

The large distance between GU Psc b and its host star is an important attribute and a major advantage when it comes to acquiring a detailed characterization of the companion object. This planetary-mass companion can be studied like few other exoplanets, because the task requires no AO systems or sophisticated high-contrast imaging methods.

We can expect this object to help by constraining models of cool brown dwarfs and exoplanets in this age range. It can also constitute a reference in the understanding of other closer-in planets we should find with instruments like GPI.

The discovery of GU Psc b makes it clear that massive planets very distant from their host stars do exist, even around low-mass stars. Although they are probably rare, they can be discovered quite easily using "standard" direct imaging techniques.

Indeed, Frédérique Baron, a Ph.D. student at Université de Montréal under the direction of David Lafrenière and Étienne Artigau, will expand the present survey with deep z- and J-band imaging at Gemini and CFHT, targeting a sample of 300 stars. This survey will be sensitive to objects down to 1-2 times the mass of Jupiter at separations ranging from 200 to 5000 AU.

We expect to find more of these peculiar planets in the future. Their unique characteristics will allow us to not only study them in great detail but also improve our knowledge of giant exoplanets and other exotic planetary systems.

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Nancy A. Levenson

Science Highlights

This month's Science Highlights reveal how Gemini's evolving suite of state-of-the-art instruments are providing astronomers with the tools needed to explore the origins of lenticular galaxies, energetic outflows from active galactic nuclei, and star-forming clumps in high-redshift galaxies.

The Origin of Lenticular Galaxies

Lenticular (S0) galaxies are more common now than they were in the past, implying that they represent the late stages or endpoints of galactic evolution. Their precursors are likely spiral galaxies that have lost their disks. New work led by Evelyn Johnston (University of Nottingham) specifically traces the properties of their component stellar populations to provide evidence for this transformation.

The research team found that, unlike spiral galaxies (such as the Milky Way), lenticular galaxies have bulges that are younger and more metal-rich than their disks. The team describes an evolutionary process whereby enriched gas in the spiral disk moves to the bulge, providing the material for the last episode of star formation in the new lenticular galaxy.

The researchers concentrate on a sample of 21 S0 galaxies located in the Virgo Cluster. They employ a novel analysis technique, which uses the spatial light profile to decompose the separate bulge and disk spectra for each galaxy. This simple spatial model consists of only the bulge and disk components, so complicated morphologies, such as dust lanes and rings, are problematic.

In all cases, the team needs high signal-to-noise ratios to extract the distinct spectra, which is possible in the relatively nearby Virgo Cluster and using the Gemini Multi-Object Spectrographs (GMOS) at both Gemini North and South. Absorption lines yield age and metal-

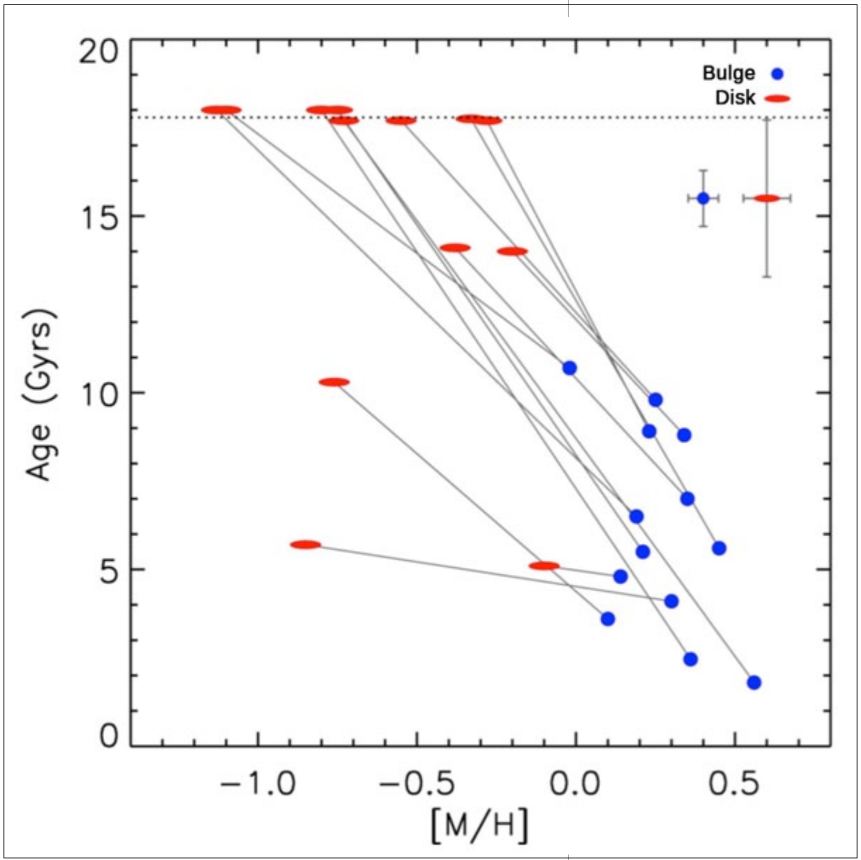

Figure 1.
Estimates of the relative ages and metallicities of the bulges (blue circles) and disks (red ellipses) of the S0 galaxies in the Virgo Cluster. Solid lines link bulge and disk stellar populations from the same galaxy. The general trend shows younger, more metal-rich bulges relative to their corresponding disks.

licity values, with stellar indices measured directly and stellar models used to derive physical properties. While different models would provide different absolute values, the sense of the relationships remains robust, with younger and more metal-rich stellar populations in the disks (Figure 1) — the result of recent episodes of star formation in enriched material.

The cluster environment, too, is likely important in the evolutionary process, which requires a traumatic event to strip the disk gas (quenching star formation there) and funnel it toward the galaxy's center. The rich environments of clusters do provide such opportunities for the progenitor spiral galaxies to interact with other galaxies and the diffuse cluster medium. This work, however, is not sensitive to the possible effects of environmental variations.

Full results are published in *Monthly Notices of the Royal Astronomical Society*, **441:** 333, 2014, and a preprint is *available*.

Galaxy-wide Outflows Common Among Quasars

New work shows that galaxy-wide outflows are common among galaxies that host luminous quasars. The underlying energetic source of these outflows is unclear, being related either to the accretion onto the central supermassive black hole or star formation. Some process to inject mass and energy into the surroundings does, however, appear to be an essential aspect of cosmic evolution.

In addition to depositing chemically-enriched material in the halo and larger intergalactic environment, outflows may be a key link that provides feedback between the growth of central black holes and star formation, which accounts for the present-day distribution of galaxy properties.

Chris Harrison (Durham University) led the study, based on observations of 16 luminous quasars at redshifts $z < 0.2$. These are all type 2 (*i.e.*, obscured) radio-quiet quasars exhibit-

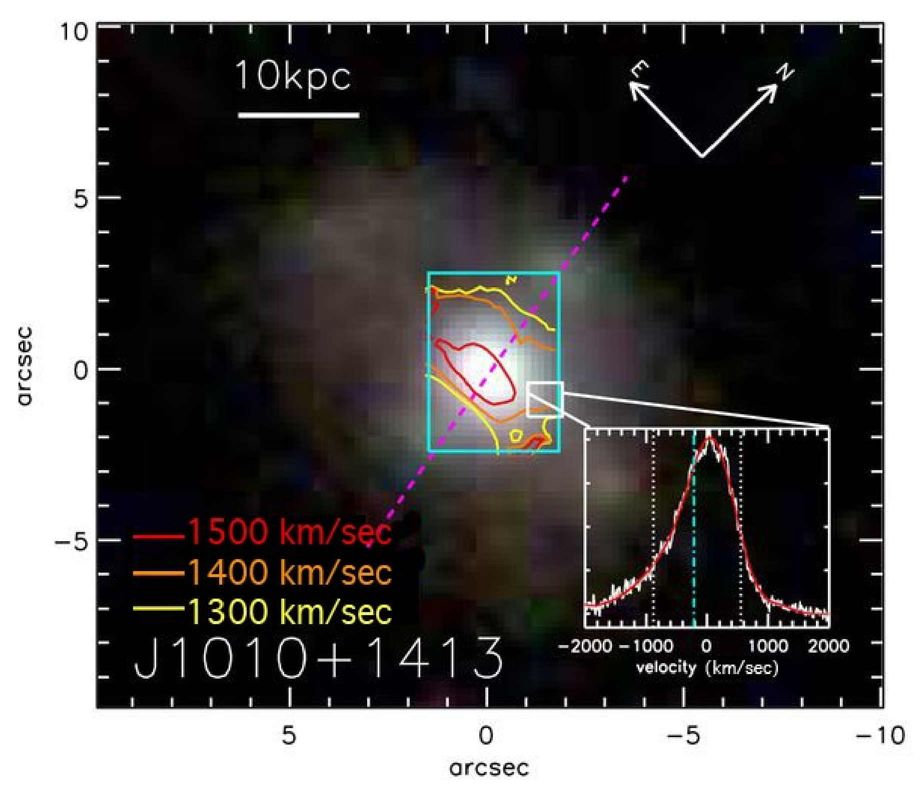

Figure 2.
An example object from the GMOS observations. The background image is from the Sloan Digital Sky Survey. The cyan rectangle shows the GMOS IFU field-of-view. The red/yellow contours show the distribution of high-velocity ionized gas. The inset shows an example oxygen emission-line profile ([O III] 5007) that was used to trace the gas velocity.

ing ordinary rates of star formation. Selected from a parent sample of 24,000 galaxies, these observations yield general conclusions about the frequency, properties, and impact of galaxy-wide energetic outflows.

The targets are relatively high luminosity, with active galactic nucleus (AGN) contributions $L_{AGN} \sim 10^{45}$ erg/sec. They also exhibit spectrally broad [O III] emission, but this is not unusual, being characteristic of nearly half the parent sample, even without correcting for the difficulty of measuring weak broad components.

The team obtained data using the GMOS-South Integral Field Unit (IFU), which enables spatially resolved kinematic measurements based on emission of Hβ and [O III]. Bulk outflow velocities are typically in the range of 500 to 1000 km/sec, and the emission-line profiles of the two species are generally similar.

The researchers find that the ionized oxygen emission extends over sizes of 10-20 kiloparsecs, or even beyond the observed field-of-view (Figure 2). Mass and energy are flowing, with mass outflow rates typically 10 times the star-formation rate, though it is not certain whether this material will permanently escape to the galaxy halo.

Disentangling the source of the outflow as either star formation or the AGN is difficult. There are no obvious morphological differences between the two. Energy-scaling arguments alone are insufficient, since the underlying power — luminosity from star formation, AGN, and related radio sources — is generally correlated. A mix of all sources may be important. Nonetheless, these results are broadly consistent with theoretical models of AGN-driven outflows that contribute to galactic feedback.

The complete results, including detailed analysis of the individual galaxies observed, are published in *Monthly Notices of the Royal Astronomical Society*, **441:** 3306, 2014, and a preprint is available.

Studying High-redshift Star Formation Nearby

Star-forming clumps are characteristic of high-redshift galaxies, especially around the peak epoch of star formation at $z \sim 2$. However, the endpoint of these massive clumps of dense gas is uncertain; they could evolve to provide the galaxy's thick disk and bulge, or they could be disrupted in place.

More sensitive observations and detailed analysis are possible in the examination of nearby galaxies; the challenge is to identify appropriate analogs in the nearby universe where these phenomena are uncommon.

Robert Bassett (Swinburne University of Technology) and colleagues present two examples of these rare, more local, analogs, ultimately favoring the first scenario and predicting that the clumps will supply the

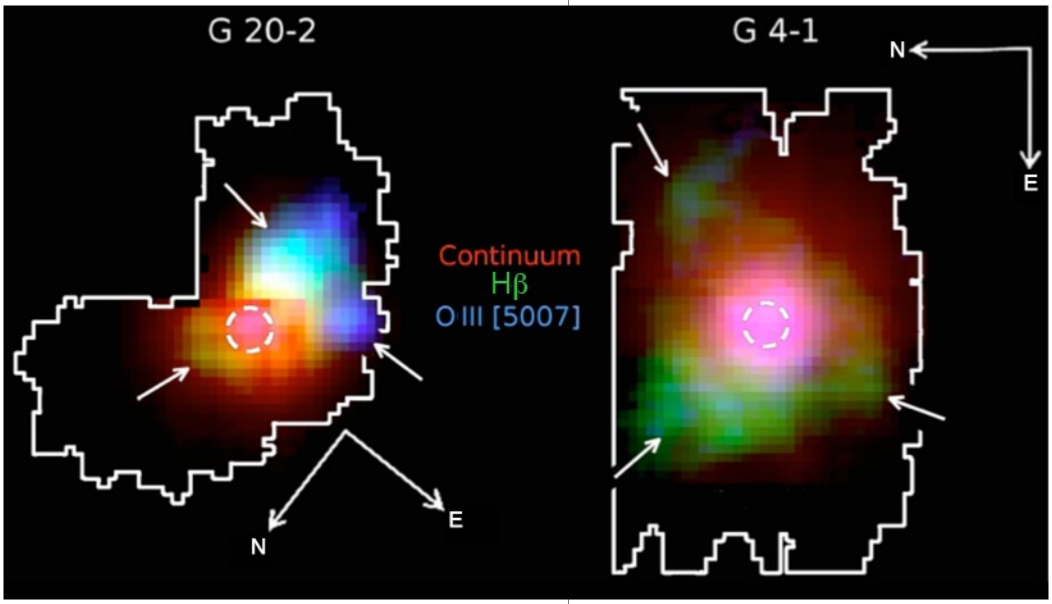

Figure 3.
False-color images of the galaxies constructed from the Gemini IFU data, with continuum, Hβ, and [O III] in red, green, and blue, respectively. The circles show the continuum peaks, which are coincident with the kinematic center in each case. The arrows mark locations of clumps, which are evident as local emission-line peaks.

hosts' thick disks, rather than dissipate. The studied $z \sim 0.1$ galaxies were selected from among a larger sample identified by large Hα luminosity, which then further showed smooth rotation of their disks. These cases are additionally similar to the high-*z* examples in stellar mass and in high luminosity of the detected gas clumps (Figure 3).

The observations were made using the Gemini Mulit-Object Spectrograph Integral Field Units on both Gemini telescopes. Stellar absorption lines and ionized gas emission lines provide kinematic measurements of the stellar and gas components of the galaxies. Both the gas and the stars show smooth rotation and large velocity dispersion.

The kinematic similarity of these components suggests a common external origin for turbulence that results in the large velocity dispersion, as opposed to a feedback mechanism whereby stellar processes (including winds and supernovae) act on the gas alone.

A preprint is now *available* and publication is forthcoming in *Monthly Notices of the Royal Astronomical Society*.

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Contributions by Gemini staff

News for Users

News for Users is a fresh feature in GeminiFocus that brings our user community the latest news briefs and updates from Gemini's operations and instrument development programs. This installment highlights several significant announcements regarding instrument development at Gemini South, as well as the way Gemini users will interact with the National Gemini Offices in the future, and more.

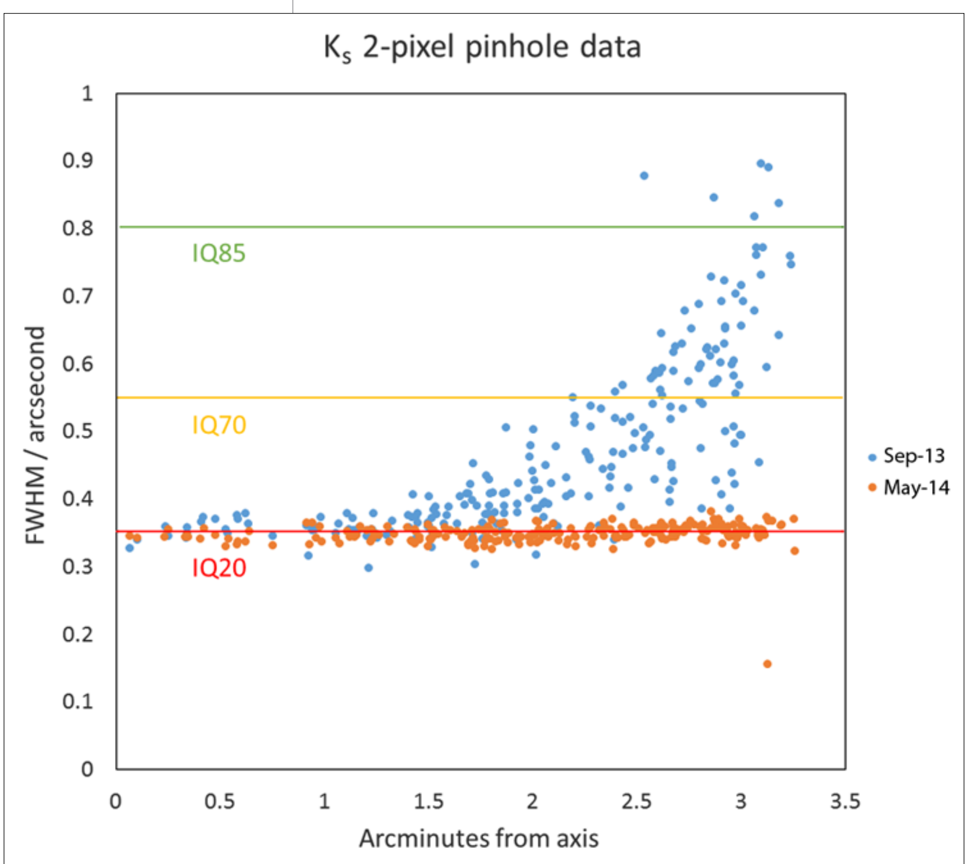


Figure 1.
Point-spread-function plot of F-2 imaging as measured relative to the center of the optical axis before (blue) and after (orange) reversal of lens mentioned in text.

FLAMINGOS-2 Developments

Although FLAMINGOS-2 (F-2) was successfully recommissioned in late 2013, the optical system had significant problems. An intensive series of consultations, modeling, and investigations determined that the problem was an inverted lens in the camera barrel. This required removal from the telescope and remedial work in April 2014. The problem was rectified in this work, and the instrument has returned to the telescope. The image quality is now excellent across the entire field-of-view (Figure 1).

Spectroscopic performance has benefited somewhat from the change, but spectral resolution away from the center remains well outside of specification. Further modeling is required to determine how to return the instrument to optimum performance — as demonstrated earlier during commissioning tests.

GeMS Laser

The GeMS laser, specified for 50 Watts (W), has experienced significant issues and in early 2014 its power output deteriorated to 20 - 30W. Nevertheless, GeMS operations proceeded with scheduled runs in April, May, and June (Figure 2). Serendipity played a role in these runs; the return of a seasonally strong sodium layer enabled us to obtain some good data for Principal Investigator programs. With winter now in full swing in the Southern Hemisphere GeMS will return to the lab, and work will continue on returning the laser to a higher power level, which will surely be needed for consistent science returns in the next southern summer when sodium returns are lower.

GMOS CCDs

The new focal plane for the Gemini Multi-Object Spectrograph at Gemini South (GMOS-S) — equipped with three red-sensitive Hamamatsu CCDs — was shipped to Chile early in 2014. The instrument team then carried out intensive "burn-in" testing in the lab before installing it into GMOS-S. GMOS returned to the telescope two weeks ahead of schedule, and on-sky tests are currently underway as illustrated in Figure 3. Images and spectra taken with these new detectors may appear by the time the next issue of *Gemini*Focus goes to press.

Evolving User Support by Gemini and the NGOs

Starting in 2014B, Principal Investigators (PIs) will notice some changes in the way their programs are supported. The changes should provide more efficient support for PIs in the way they prepare their observations.

Figure 2:
Gemini South laser propagates into the sky over Cerro Pachón. Despite lower power, many programs were successfully fulfilled due to the seasonal variations in the atmospheric sodium layer which provided stronger guide star returns.

Figure 3.
Gemini Staff scientists Kathy Roth (left) and Kristin Chiboucas (right) assist in observations at Gemini South (led by German Gimeno) using GMOS with its new, extended-sensitivity Hamamatsu CCDs from the Gemini North Base Facility. Gemini South observing staff in La Serena, Chile, and at the summit of Cerro Pachón, are visible on the screen at top.

They will also free up much-needed time for Gemini personnel to better support the later stages of the science program lifecycle — through to publication. For various reasons, these changes will come in stages and will differ from partner to partner.

The biggest single development in 2014B is that PIs in the United States will be supported in the Phase II preparation by Gemini staff astronomers, who will see U.S. programs through the entire process — from Phase II to execution on the telescope. A U.S. National Gemini Office (NGO) member will act as consultant to the Gemini staff astronomer; this NGO person will in most cases be the same one who carried out the technical assessment of the proposal. The U.S. NGO staff are also ready to support programs themselves should this prove necessary. This arrangement is a prelude to the U.S. NGO staff taking up other work, such as the writing of data-reduction cookbooks, *etc*.

For 2014B, the Phase II process for non-U.S. partners will also change in the following manner: Support for a given PI's program will be provided by a specialist in their selected observing mode, in some cases not located in the PI's home NGO. Support by a "second pair of eyes" will be provided both within the Observatory and by an NGO member at the PI's home NGO.

Gemini Planet Imager

The commissioning of GPI continues with the most recent success being a six-night run in May. Immediately following the run, the summit crew dismounted the instrument from the Instrument Support Structure (ISS) and relocated it to the Instrumentation Test Room for a final round of software improvements. GPI goes back on the ISS after the August Gemini South shutdown and preparations will proceed for the final commissioning run currently scheduled from August 30th until September 4th. The GPI Campaign is expected to begin in November.

Operationally, the 2014B programs are now in Phase II and the latest version of the Observing Tool has GPI skeletons implemented. These skeletons allow a one-click approach to have fully-defined observations. A total of 12 GPI science programs now exist; requiring 72 hours of telescope time.

For many involved in the Gemini Planet Imager (GPI), recent efforts have concentrated on preparation for the SPIE 2014 conference in Montréal in which GPI had a huge presence. The extended GPI team delivered almost 20 presentations on various aspects of the instrument. See all Gemini-related SPIE abstracts here.

Gemini North Dome Repairs

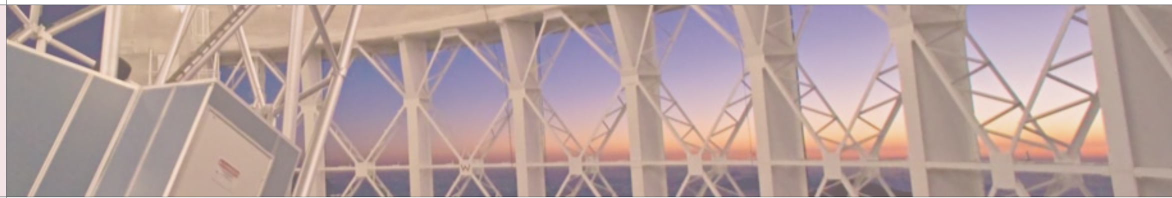
In late May, the discovery that the second dome shutter drive unit had failed at Gemini North prompted an unscheduled shutdown in order to make necessary repairs (Figure 4). Because this is the second of these drive units to fail at Gemini North, the repairs went relatively quickly and downtime was kept to a minimum (in the earlier instance the weather was also an issue; see article in the previous issue of *Gemini*Focus for details on repairs to the identical unit on the opposite side of the dome top shutter). Work is ongoing to better understand why these units both failed at Gemini North and to minimize the possibility that they will do so unexpectedly at Gemini South.

Figure 4:
Dome shutter drive unit, in which a critical bearing had sheared, causing its alignment to skew (lower aqua-colored box) and render the unit inoperable. The entire mechanism weighs about 4 tons and had to be removed from the dome for servicing.

For more details on this work, see the blog that features highlights from the shutdown (including a video illustrating the difficulties of accessing the drive unit) [available here](#).

2014B – Emphasis on Large and Long Programs

Principal Investigators for all approved semester 2014B Gemini proposals received their email notifications on June 17th. Semester 2014B marks the first for Gemini Planet Imager regular science operations, the initial semester of Large and Long Programs, and the first full semester with the new, extended-sensitivity, GMOS South CCDs. For more details see the Large and Long Programs webpage, [available here](#).



Contributions by Gemini staff

On the Horizon

A new feature in GeminiFocus, On the Horizon provides quarterly updates on future, long-term developments at Gemini that should benefit our user community.

Base-facility Operations

By 2016, Gemini intends to operate both telescopes from their prospective base facilities — Gemini South from La Serena, Chile, and Gemini North from Hilo, Hawai'i. The plan is to achieve this goal in stages.

The first significant milestone is to remotely open the dome at Gemini South in order to permit it to equilibrate ahead of the night observing staff's arrival (Figure 1). According to Gemini's Associate Director of Operations Andy Adamson, this "quick win" provides much insight into the ultimate requirements for base operation.

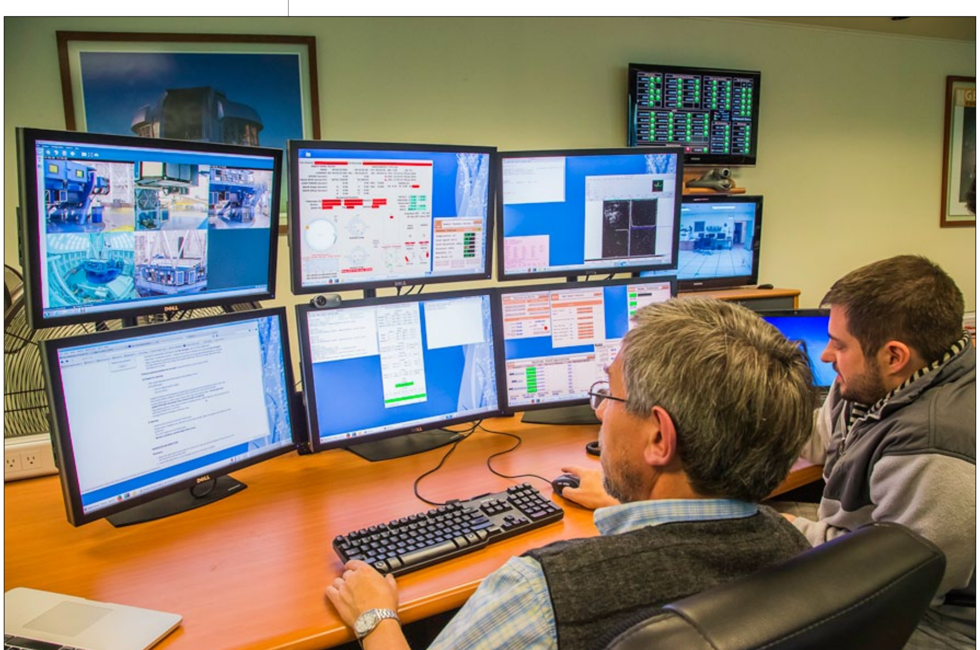


Figure 1. *Science operations specialist Erich Wenderoth (left), and systems engineer Andrew Serio (right), open the dome of the Gemini South telescope remotely from the La Serena Base Facility, without the assistance of an operator at Cerro Pachón. This milestone is part of the Base Facility Operations (BFO) project targeted to allow full, remote operations, by the 1st half of 2016.*

The remote system includes comprehensive coverage of the dome and telescope with operable video cameras. This will enable staff to perform a thorough safety check of the dome and telescope before committing to opening the shutter. Weather conditions will be continually logged and the system will not allow the dome to be opened unless a series of preset criteria are met.

Fast Turnaround

Over the next few months, Gemini staff will be preparing to launch the new Fast Turnaround proposal mode. This program will offer monthly proposal deadlines and a rapid review of proposals. Accepted programs will be ready for scheduling within a month of the proposals being received. The Fast Turnaround scheme will offer Gemini users new opportunities to follow up unexpected astronomical events or discoveries, carry out pilot studies, or quickly obtain the data needed to finish a Ph.D. thesis, among others.

One novel aspect of the program is that Principal Investigators (PIs) will review each other's proposals. Thus, submitting a proposal also commits the PI (or a co-investigator) to providing grades and brief written assessments of up to 10 proposals submitted during that round by other astronomers. Gemini staff will then use this combined assessment of scientific merit to create a "mini-queue" of programs that will be executed on three nights per month reserved for Fast Turnaround observations.

The program's design — including the peer review system — has been assessed by a committee of internal and external experts, and, in May 2014, the Gemini Board of Directors gave approval to launch a trial using 10 percent of the telescope time at Gemini North. (The remainder of the telescope time will continue to be available for regular proposals, Large and Long Programs, *etc*. for the foreseeable future.)

During the rest of this year, we will be establishing the software and procedures necessary to run and monitor the program, in time for the first proposal deadline at the end of January 2015. More information will be made available as the program's web pages are developed; readers may also be interested in the recent SPIE proceedings describing the design of the plan (*available here*).

GHOST

In April 2014, the Association of Universities for Research in Astronomy delivered to the Sydney-based Australian Astronomical Observatory (AAO) a signed contract for the design, building, testing, and commissioning of the Gemini High-resolution Optical SpecTrograph (GHOST, previously referred to as GHOS) –– for use on the twin 8-meter telescopes. AAO will have two partners on the project: the National Research Council Herzberg in Victoria, Canada, which will be designing and building the spectrograph portion of GHOST; and the Australian National University Research School of Astronomy and Astrophysics in Canberra, which will be developing the instrument's software.

Rounding out the project team roster are Gemini Operations and Development team members from both the north and south sites. They will work closely with their Australian and Canadian counterparts to ensure a smooth transition of this new instrument into Gemini operations.

Work on the project's Preliminary Design stage has been proceeding for the past couple of months. Last May, instrument technicians, engineers, and scientists gathered in Sydney, Australia, where they spent three days making significant progress. With an end of year 2014 goal to have the preliminary design ready for review, and a 3rd-quarter 2017 goal to be commissioning this new fiber-fed, bench-mounted spectrograph, the GHOST project team is on its way to providing this long-awaited capability to the Gemini community.

Gemini Generation-4 Instrument #3 Project

With development of the Gemini Planet Imager (GPI) ramping down as the instrument's commissioning nears completion, work on Gemini's next new instrument (called Gen4#3 for the third, 4th-generation instrument) is advancing.

The plan is to approach this new instrument as two distinctly different projects. First, we will solicit an open call for feasibility studies, which we expect to launch early in the fourth quarter of 2014. The goal of these funded, science-driven studies is to provide feasible concepts for an instrument consistent with the guidelines set by our Science and Technology Advisory Committee (STAC).

Once we have reviewed these studies with our community, the creation of two or more sets of specific instrument requirements will commence, allowing us to pursue the second project. Subsequently, we will issue a request for proposals for teams to bid and agree to contracts for the remainder of the work. We expect to then choose two teams, one for each instrument concept, with whom we will negotiate a contract for the remainder of the work.

We intend for this contract to include both the remaining design stages as well as the full construction, delivery, and commissioning stages. In this way, we avoid having to issue one contract for the Conceptual Design Stage and another for the remainder of the work as we have traditionally done. Depending on available funding and the success of each team review, we intend to allow one or both teams to continue to design, build, and deliver their instrument(s).

Aside from the new contracting approach, we can now work with instrument teams in additional ways by providing telescope time as partial compensation for work performed and accepting and partnering in possible in-kind contributions from our teams. By working together, we envision a continuation of necessary updates and improvements to Gemini's instrument suite using a variety of tools and contributions from the global Gemini community. Full details will be forthcoming and included in the Call for Proposals.

Peter Michaud

Fostering Career Opportunities Within our Local Communities

In addition to his duties as Senior Optical Technician, Clayton Ah Hee (below, and inset) assists with other work on the mountain, like the recent repairs of the Gemini North Shutter Drive Unit.

One way to ensure Gemini's healthy future is to reach out and enable career opportunities from within Gemini's local host communities in both Chile and Hawai'i. Take, for instance, the case of life-long Hilo resident Clayton Ah Hee. As a young man, Clayton would look up at the domes atop Mauna Kea and wonder what it would be like to work at an observatory. About 26 years ago, Clayton's dream came true and since then he has worked his way up to his current position as Gemini North's Senior Optical Technician. Clayton recalls that while growing up he always had a fascination with shiny things, like chrome-plated and polished components. "Funny that my primary role at the Observatory is to prep and apply the multilayer silver coatings on the all the major optics at Gemini!" he says.

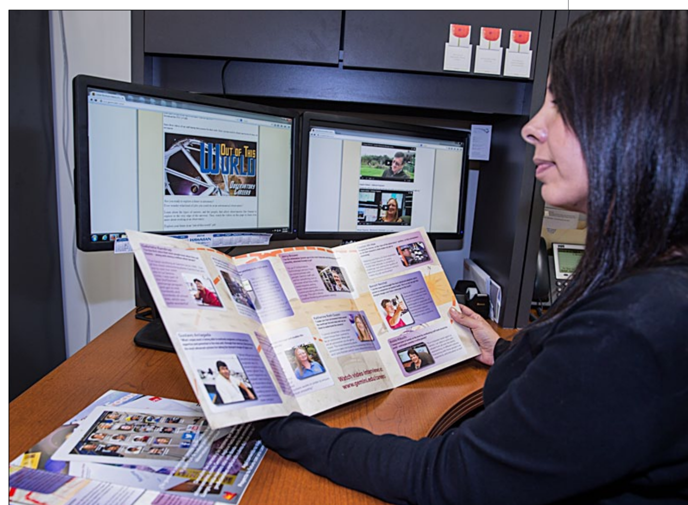
Today, Clayton is a critical element of the Gemini North summit team, which is responsible for keeping everything in top form for Gemini's nighttime operations. His success story, like many similar ones at both Gemini telescopes, is now featured in new multi-media materials that share with future career candidates the opportunities available at Gemini and other astronomical observatories.

Right: Gemini's HR Manager Christina Terminello reviews the career brochure.

"Inspiring our youth with opportunities for the future is at the core of our work," says Gemini's Human Resource Manager Christina Terminello. "Materials like this, and follow-on opportunities — such as internships through our partnerships with local Hawai'i and Chilean schools and universities — give students a glimpse of what it's like to work at an observatory and often generate a spark that can last a lifetime!"

Building Careers

To this end, the Gemini Public Information and Outreach (PIO) Office recently debuted a new careers brochure aimed at inspiring



students, residents, and others in Gemini's local host communities to consider a future at Gemini or other observatories. Available in English and Spanish, the brochure, and its companion video-interview website http://www.gemini.edu/careers present real-life stories, like Clayton's.

Scenes from staff video interviews found on the brochure's companion website. Above: Gustavo Arriagata (Gemini South); below, Bobbi Kikuchi (Gemini North).

"The careers brochure and videos provide a glimpse into the work-lives of a cross-section of our staff and what inspires and motivates them," says Joy Pollard of Gemini's Hilo PIO office, who helped produce the brochure and videos along with her counterpart Manuel Paredes in Chile.

The brochure is accessible in hardcopy, while both it and the videos are electronically available at: http://www.gemini.edu/careers

The PIO staff looks forward to creating future editions of the material that will feature more Gemini employees who will share their contagious passion for what they do. The ultimate long-term goal: to feature a local student whose career was sparked by these materials and who has followed in Clayton's footsteps (or one of the 18 staff featured in the brochure!)

Peter Michaud is the Public Information Outreach Manager of Gemini Observatory. He can be reached at: pmichaud@gemini.edu

Covers and excerpts from the Gemini career brochure. The brochure is available both in print and online, in Spanish and English.

Star trails over the Gemini South telescope as imaged by the Gemini PIO Office's Manuel Paredes.

AURA

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