

Gemini Observatory Update



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Presentation Outline

- **Recent Science Highlights**
- **Transition Plan Summary**
- **Instrumentation**
- **Future Collaboration Opportunities**



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Measuring the Mass of the Black Hole in M87

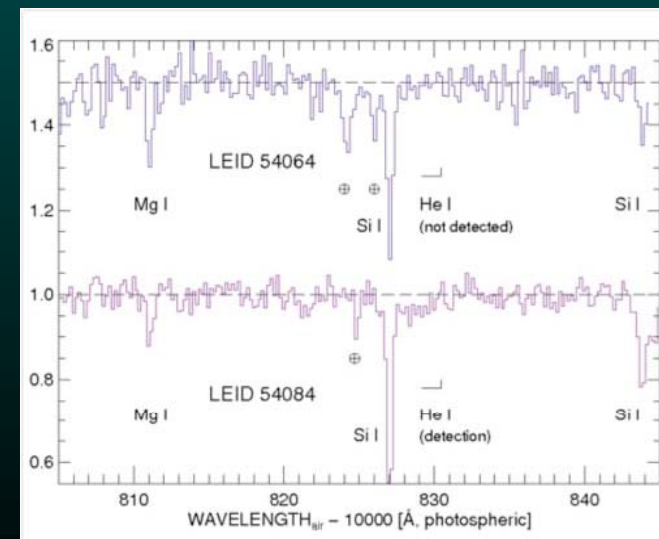
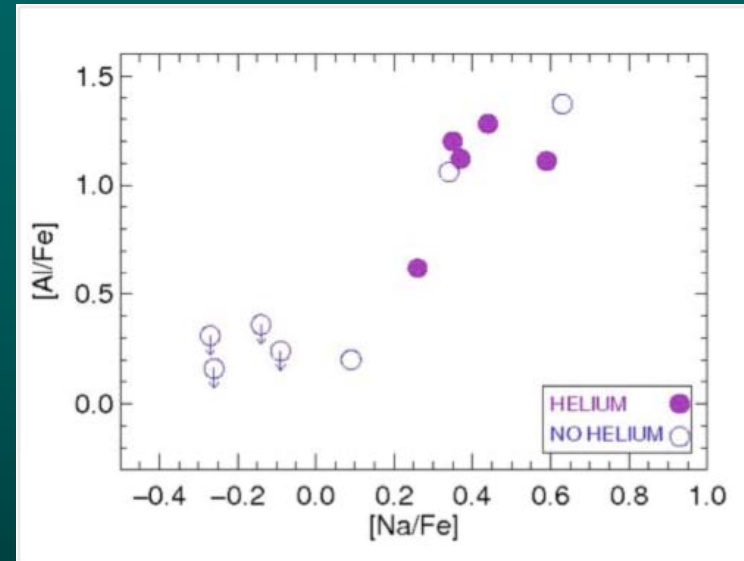
- * Result announced last week at the AAS meeting
- * Gephardt et al. used NIFS at Gemini-N and VIRUS-P at McDonald to evaluate the various mass contributors to M87
 - * AO fed NIFS used to measure dynamics of stars in BH vicinity
 - * VIRUS-P used to measure dark matter contribution in halo
- * BH mass: $6.6 \times 10^9 M_{\text{sun}}$
 - * Largest BH in our "neighborhood"





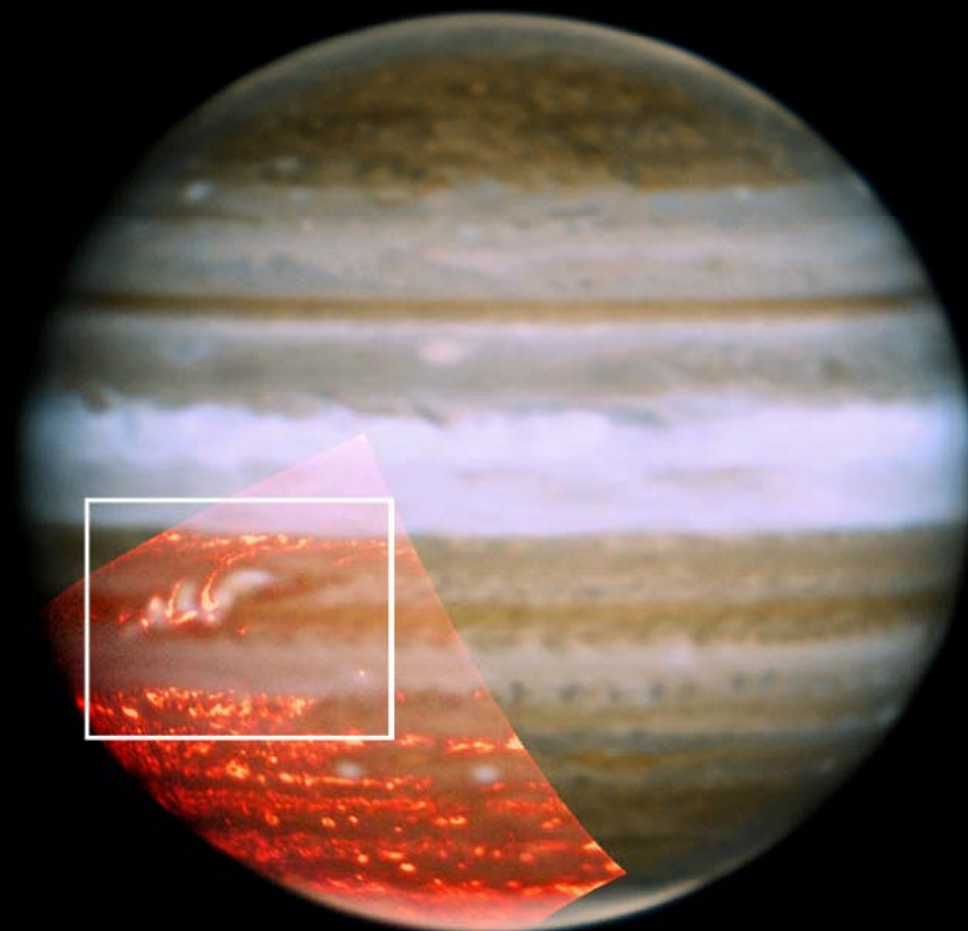
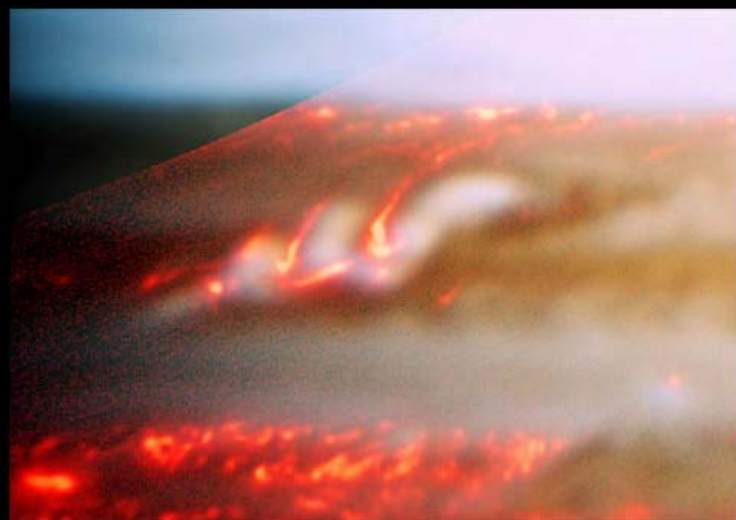
Evidence of Multiple Stellar Populations in a Globular Cluster

- ✱ Dupree et al. (2010) used PHOENIX on Gemini-S to record high-res NIR spectra of many stars in Omega Centauri
- ✱ Found that helium abundance is correlated with overall metal abundance and especially with enhancement of light elements such as Al & Na
- ✱ *Helium enhancement is interpreted to be a consequence of second-generation stars formed from enriched material processed by an earlier generation of stars*



Jupiter's SEB Outbreak
Gemini North/NIRI
18 Nov 2010

2.12 μm
1.69 μm
4.68 μm





A Very Cool, Nearby Brown Dwarf

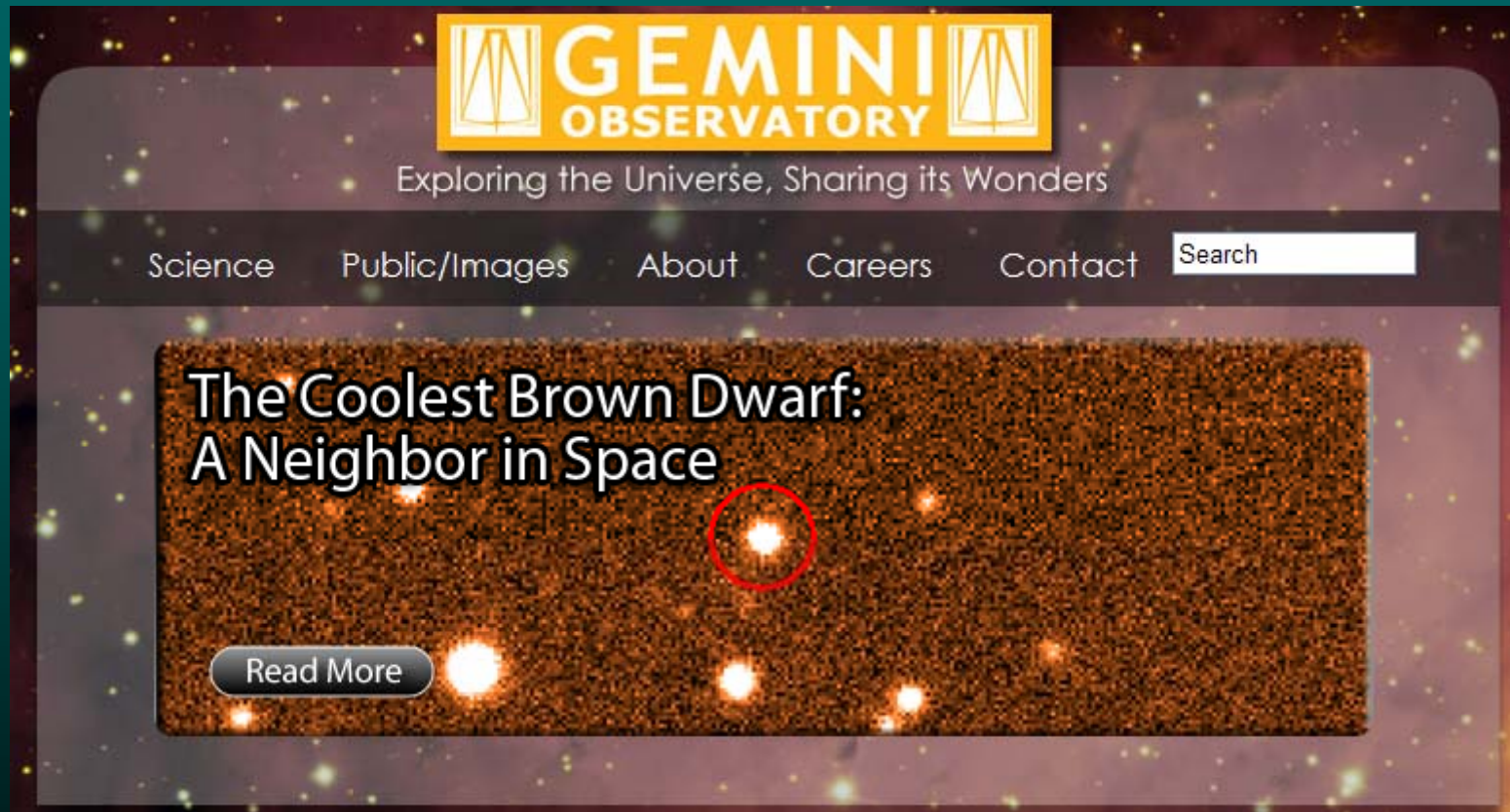


Image from the UKIRT Infrared Deep Sky Survey

✱ Isolated brown dwarf UGPS 0722-05

✱ Compared with T9 -

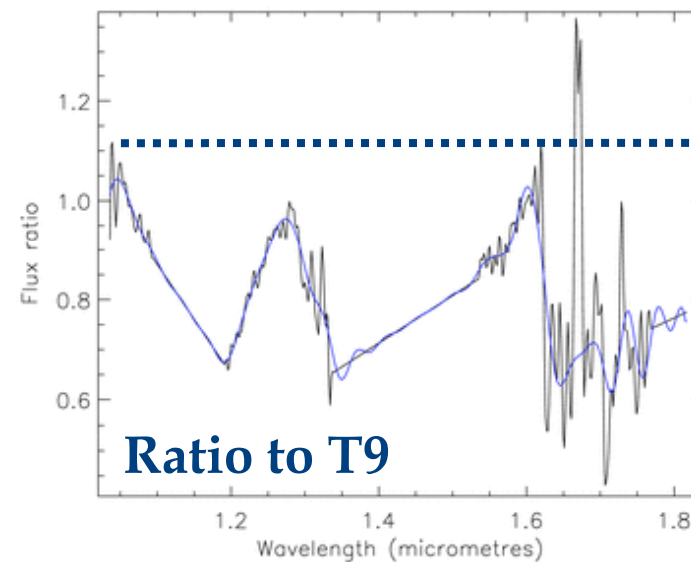
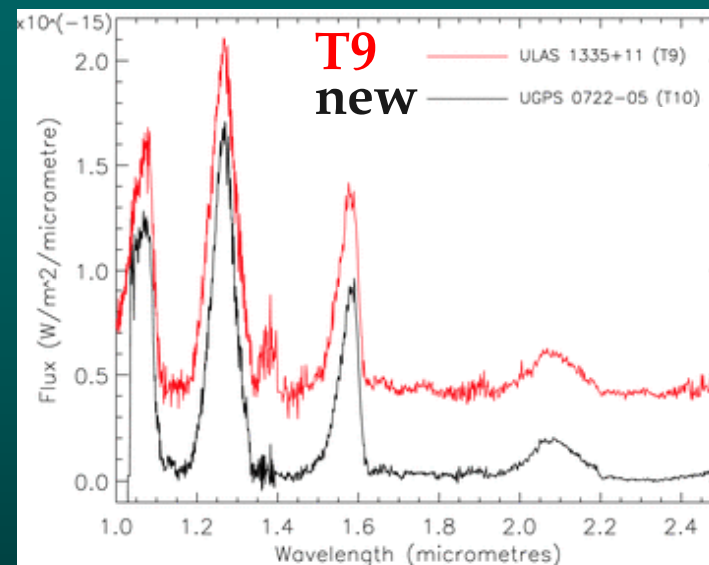
✱ Deeper absorption troughs

✱ Extreme colors → coolest BD

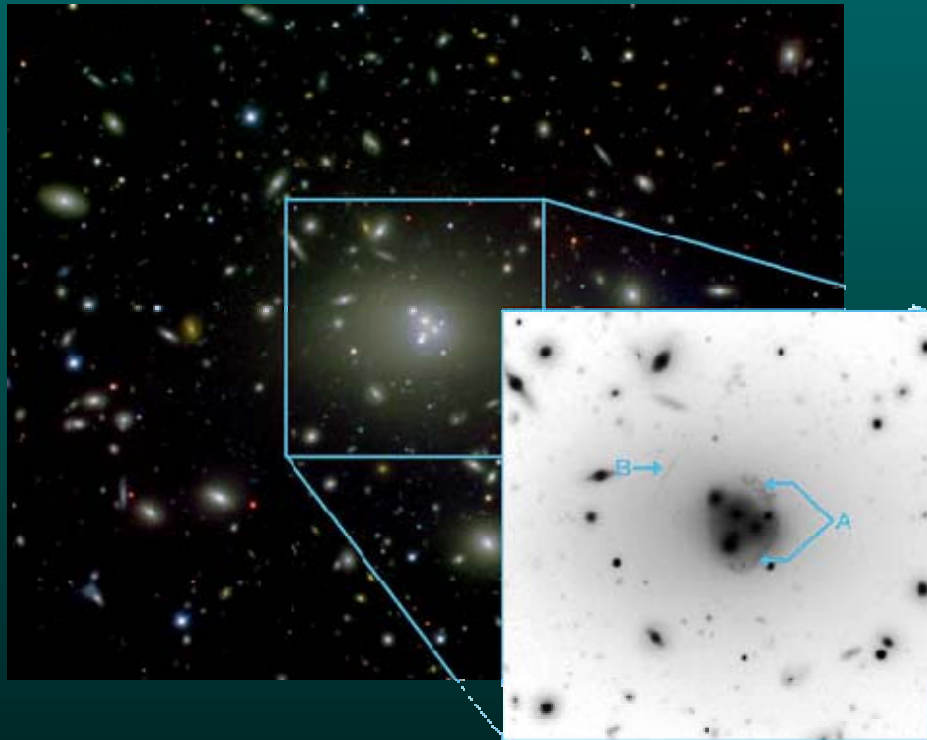
✱ $T_{\text{eff}} = 520 \text{ K}$

✱ $L = 9 \times 10^{-7} L_{\odot}$

✱ Closest known isolated BD



The Most Massive Galaxy?



- * In Abell 3827
- * cD galaxy mass
- * From gravitational lens: $M \sim 10^{13} M_{\odot}$
- * 10 times X-ray mass
- * Ongoing merger with 5 nuclei visible

Carrasco et al. 2010



Transition Proposal

- ✳ Recently released for comment Gemini's "Transition Proposal" in response to Gemini Board's Nov. 2009 directive to *"compile an executable operations plan that involves a reduction of 7% to 10% per annum in current O&M expenditures, base-lined to the 2009 revised budget ... that shall be phased into place during the period 2011 through 2013."*
- ✳ This was in response to the UK (STFC's) withdrawal of funding from a number of ground based astronomy facilities

DRAFT

A Plan for Gemini Observatory Operations Through 2015

Submitted to the Gemini Board
by the
Gemini Observatory

August 2010





Priorities

- * To deliver and operate high quality instruments and contribute that represent the priorities of the community
- * To provide a high fraction of queue operations with appropriate data quality control, data products, and completion fraction
- * To have the ability to remotely operate the telescopes
- * To better interface with the partner community

Driven by
UK Withdraw

Schedule

Cost



Priorities

Gemini Board

- * Essential component in observatory's future
- * Blend of workhorse imagers & spectrometers plus leading edge technologies (AO)
- * Replace aging instruments, keeping pace with science trends and enabling technologies
- * Coordinate development plans with other facilities



- * Require long-term affordable and sustainable operations model
- * Blend of classical and queue operations demonstrated to –
 - * Match historic demands from the community between classical/queue
 - * Segue to ever growing synoptic/ToO programs
 - * Optimally use laser AO
- * Nurture time swaps with other facilities, linking with “system” to maximize overall access for community



Laser AO at Gemini

* Laser AO at both sites will be preserved, consistent with Gemini's design strength of high performance NIR imaging



* 2011

- * Commissioning FLAMINGOS-2
 - ❑ NIR Multi-object spectrometer & imager
- * Commissioning GeMS/GSAOI
 - ❑ Multi-conjugate laser AO system plus large format AO imager

* 2012

- * Commissioning Gemini Planet Imager
- * Possible CCD upgrade for GMOS



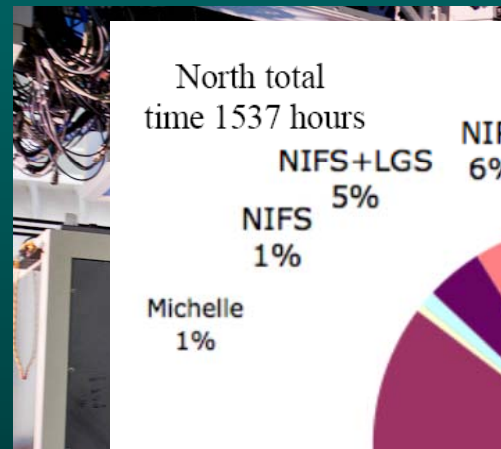
Combined, this ~\$60M influx of new instrumentation will transform Gemini-S

✧ 2010

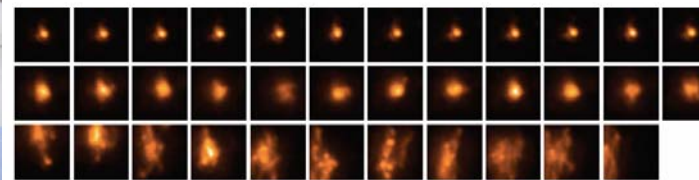
- ★ GNIRS operational
 - ✧ Science Verification interest was strong with 44 proposals submitted
- ★ In 2011A, the first semester GNIRS was offered, ~1/3 of the time allocated at Gemini-N is going to GNIRS

✧ 2011

- ★ GMOS-N CCD Upgrade
- ★ All-sky laser AO mode for NIFS



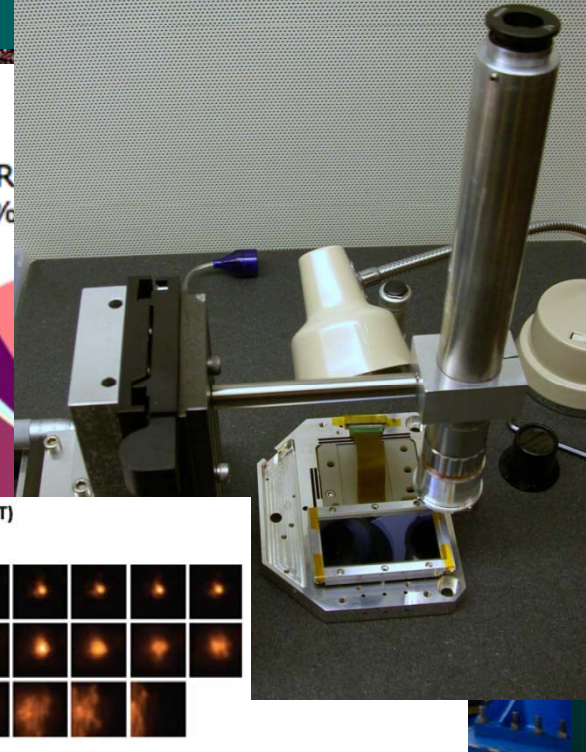
LGS+P1 Tests 20100505 (UT)



Top:	LGS + STRAP + SFO	Seeing = 0.583" ± 0.111"
Middle:	LGS + P1 (Fixed SFO)	Seeing = 0.680" ± 0.211"
Bottom:	LGS Only	Seeing = 0.529" ± 0.055"

$\lambda = 2.12 \mu\text{m}$

New GMOS-N CCDs



A-N

All-sky laser AO for NIFS

* High Resolution Optical Spectroscopy

* HDS

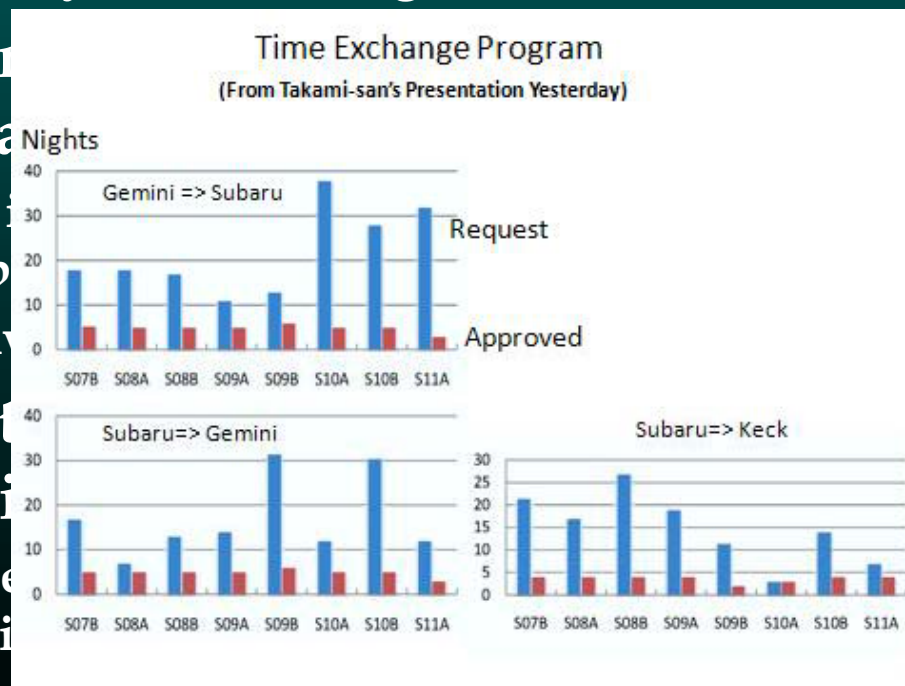
- Would like to increase demand/access to this instrument but its access to the Gemini community is limited by constraints of the time exchange program and HDS alone will likely not be enough to meet Gemini demand

* Evaluating Gemini access

- Driven by demand and expense
- Red wave

* New instrument for Gemini

- RFP related capabilities



between
(R~70K)

of access time
be developed

ped, likely

rmine cost and



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New Instrument Development

- * Beyond high-res optical spectroscopy, we are examining options to start other new instruments as part of our new budget
 - * Planning start-ups of new instruments through 2015
 - * Anticipate \$4-5M/yr for new instruments
- * Will be discussed during the next Gemini Science Committee meeting in April (Hilo)
 - * *Would like Japanese involvement in that meeting to help define Subaru/Gemini community interests and identify development collaboration opportunities*
- * Some possibilities include –
 - * Ground Layer AO system (GLAO)
 - * New wide field/AO NIR imager
 - * High-res NIR spectrometer
 - * X-shooter like instrument

- ✱ As part of reducing our costs Gemini will likely consolidate its MIR capabilities on a single telescope
 - ✱ MIR capabilities are fairly complex and expensive to maintain (chopping)
 - ✱ Demand has been historically small compared to other instruments/modes offered, so hard to justify investment at current levels given our budget constraints
 - ✱ Balancing “4+AO” on each telescope, combined with the superiority of Mauna Kea as a MIR site, leads to Gemini-N being the preferred site of future MIR capabilities at Gemini
 - ✧ Not clear yet if we would use MICHELLE or T-ReCS at Gemini-N
 - ✱ Debated within GSC and aware of implications for MIR science at Gemini-S (ALMA follow-up)
 - ✧ Significant overlap in sky coverage between Gemini-N/S will help mitigate this



Possible Instrument Line Up (~2012)

Gemini-N	Gemini-S
GNIRS (available 2011A)	FLAMINGOS-2 (starting 2011)
GMOS-N (upgraded 2011A)	GMOS-S (upgraded 2011?)
NIFS	GSAOI (commissioned 2011)
T-ReCS or MICHELLE ?	NICI (replaced by GPI in 2012)
ALTAIR (replaced by GeMS-N or GLAO?)	GeMS

Yellow = long term future/need, Red = short term (few years) future

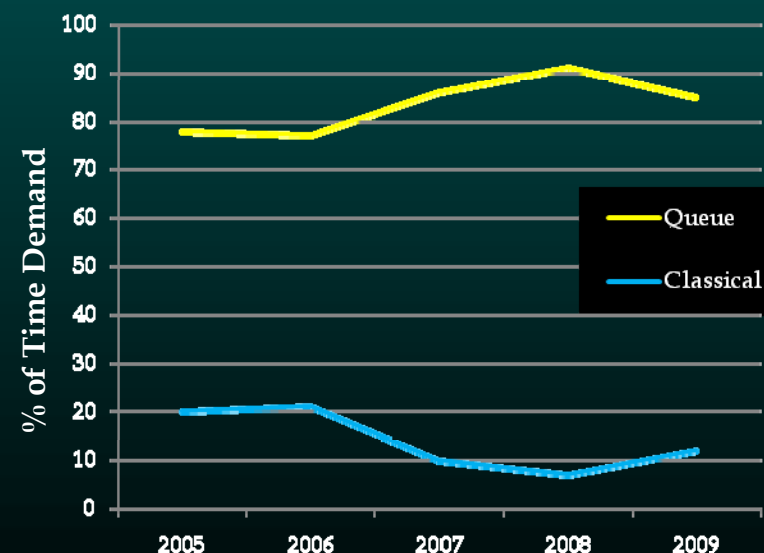
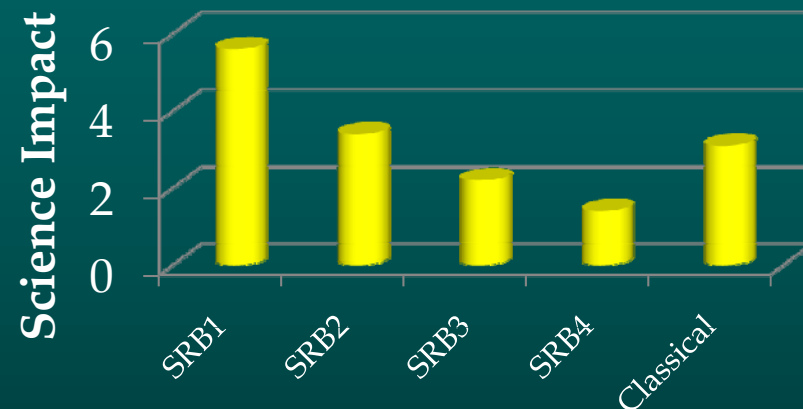
- Note that NIRI is not on this list, will decommission in a few years
- Will seek GSC endorsement of replacement GN instrument (NIR imager?) at the next GSC meeting



Blend of Operating Modes Remain in Gemini's Future

- * A blend of classical and queue based operations will be provided, recognizing the attributes and historic demands of both approaches
- * To reduce costs Gemini's queue will be run primarily with non-research staff
 - * Reduced PhD core will handle queue coordination and classical programs
- * *We will be developing innovative modes in the future as well...*

Science Impact vs. TAC Ranking





Keck

- Waimea remote op's
- California remote Op's
- Staff on mountain

CFHT

- Remote op's from Waimea since 1 Jan 2011
- No staff on mountain

IRTF

- Remote op's via VPN from essentially anywhere
- Staff on mountain

UKIRT

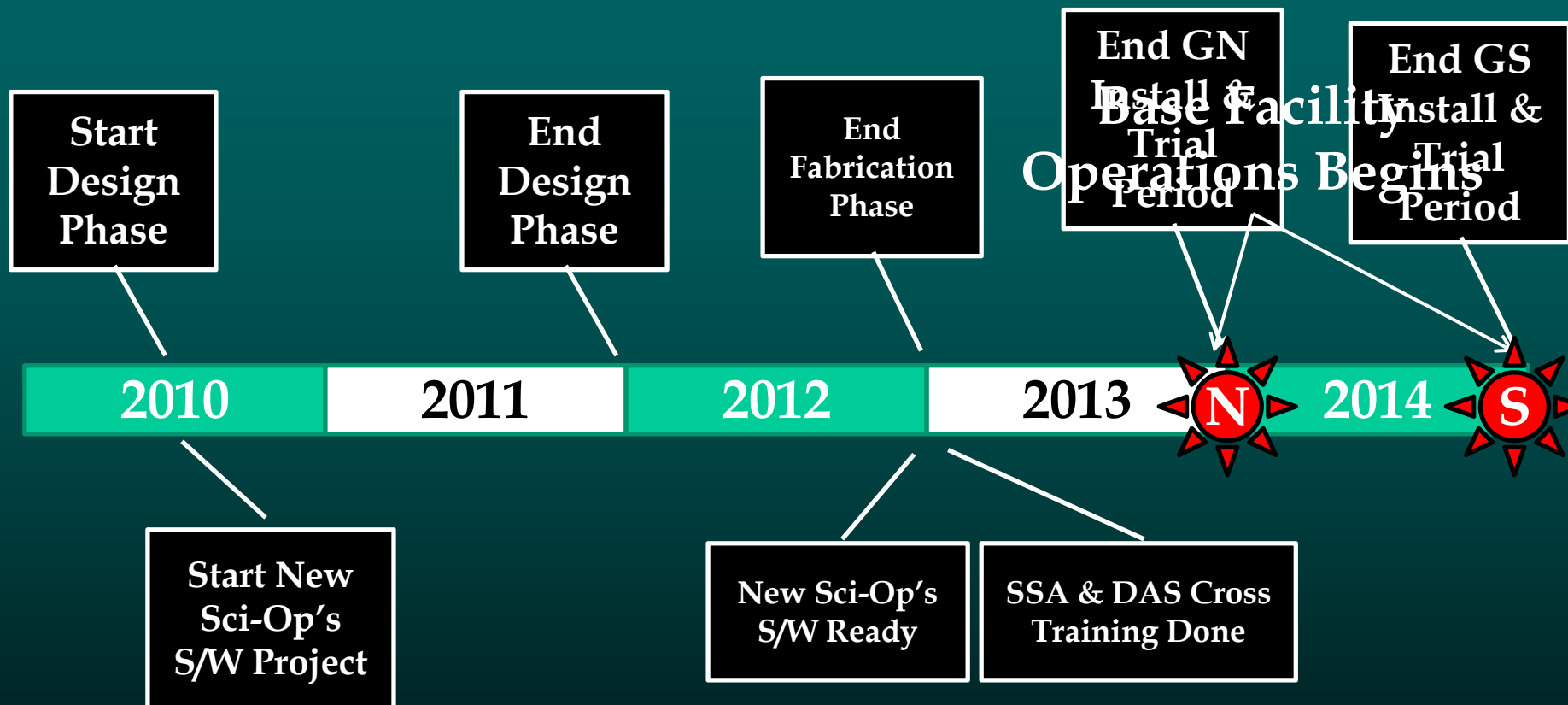
- Remote op's from Waimea since 1 Jan 2011
- No staff on mountain

UH 88"

- Honolulu/Hilo remote op's
- No staff on mountain



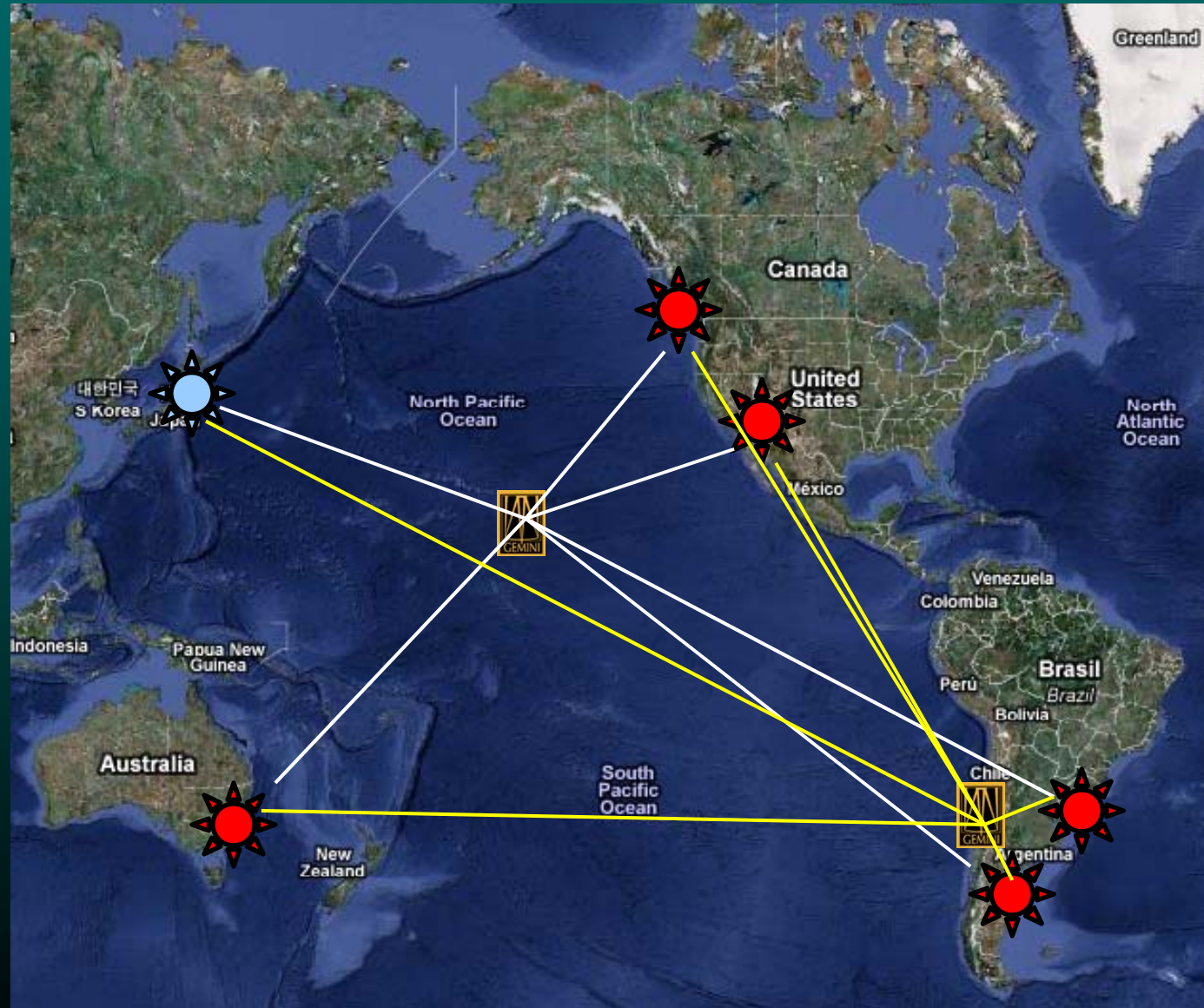
Nominal Timeline for Developing Base Facility Op's





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Eavesdropping, Remote Observing, & Building Community Bridges





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Exploring the Universe, Sharing its Wonders

