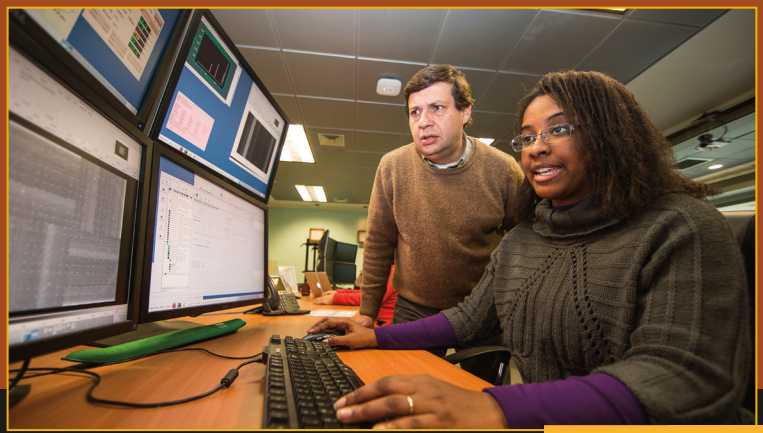
NSF's National Optical-Infrared Astronomy Research Laboratory

# Gemini Capabilities






GEMINI OBSERVATORY

*Exploring the Universe, Sharing its Wonders*

http://www.gemini.edu/caps-pdf

2020

*Gemini Multi-Object Spectrograph, North and South*

## GMOS - N & S

- Broad (u', g', r', i' and z' Sloan) and Narrow band optical imaging
- (5.5' × 5.5' FOV), long slit, multi-object and integral field spectroscopy (0.36 –1.03 µm)
- Nod and Shuffle spectroscopic mode (all modes including IFU)
- Spectral resolutions ~ 150 – 8700 in 1st order, up to 12,000 with some gratings in second order
- Detector array populated by 3 Hamamatsu fully depleted CCDs

*Gemini Planet Imager*

## GPI

- Extreme AO system for coronographic integral field spectroscopy and polarimetry
- Diffraction-limited images 0.9 – 2.4 µm over 2.8" × 2.8" FOV, sampling 14 milliarcseconds
- Spectral resolution ~40 in H band
- Contrast of ~ $10^{-5}$ at 0.4" radius

*Gemini Near-Infrared Spectrograph*

## GNIRS

- Near-infrared (0.8 – 5.4 µm) long-slit and cross-dispersed spectroscopy
- Spectral resolutions ~ 1200– 18000 in long-slit mode
- Cross-dispersed spectroscopy delivering complete 0.8 – 2.5 µm coverage at R ~ 1700 and partial coverage at higher resolution
- Integral field units to be available in 2021: 5" × 3" FOV with natural seeing, and 1"x1.5" with Altair adaptive optics system

*Near-Infrared Imager*

## NIRI

- Near-infrared imager with three cameras
- 22" × 22", 51" × 51", or 120" × 120" FOV
- Wavelength coverage from 1 – 5 µm with 8 broad-band and 21 narrow-band filters
- Spatial resolution up to FWHM ~ 0.08" with Altair adaptive optics system

*Gemini South Adaptive Optics Imager*

## GSAOI

- Near-infrared imager used with GeMS
- 85" × 85" FOV, sampling 20 milliarcseconds
- 22 narrow and broad-band filters covering 0.9 – 2.5 µm
- Diffraction limited imaging in the K-band

*FLAMINGOS-2 Near-Infrared Imager/Spectrograph*

## FLAMINGOS-2

- Near-infrared imager (6.1' diameter FOV)
- Long slit spectroscopy (0.9 –2.4 µm)
- Spectral resolutions ~ 300– 4500
- Ongoing commissioning of multi-object spectrograph mode (2' × 6' FOV)

*Altair Adaptive Optics System*

## Altair

- Natural guide star mode, FWHM ~ 0.07" with Strehl ratios up to 40%
- Laser guide star mode, FWHM ~ 0.08" with Strehl ratios up to 20%
- Used in conjunction with GNIRS, NIFS, or NIRI
- Future integration with GMOS
- Nearly full sky coverage "super seeing" mode yields FWHM ~ 0.3"

*Gemini Remote Access to CFHT ESPaDOnS Spectrograph*

## GRACES

- 270-meter fiber optic cable feeds the echelle spectrograph at the Canada France Hawai'i
- Wavelength coverage: 0.4 –1.0 µm continuous
- Spectral resolutions: 40,000 (target and sky observed simultaneously), 68,000 (target only)

*Gemini Multi-Conjugate Adaptive Optics System*

## GeMS

- Multi-conjugate adaptive optics system uses up to three deformable mirrors, five laser guide stars, and three natural guide stars
- High Strehl ratios and spatial resolution up to FWHM ~ 0.06" over 85" x 85" FOV
- Currently used with GSAOI, with other instrument options possible in the future

*Gemini High Resolution Optical Spectrograph*

## GHOST

- Two-target simultaneous spectroscopy over a 7.5' field, at a spectral resolution >50000
- Single target spectroscopy at spectral resolution >75000
- Accuracy down to ~ 10 m/s within 0.43– 0.75 µm
- Commissioning in 2020

*Near-Infrared Integral Field Spectrograph*

## NIFS

- Near-infrared (0.95 – 2.4 µm) integral field spectrograph and coronagraphic imager (3" × 3" FOV)
- Spectral resolution ~ 5000-6000
- Spatially-resolved spectroscopy on 0.15" scales with Altair adaptive optics system

*Speckle imaging at Gemini North and South*

## 'Alopeke & Zorro

- Identical low-noise optical imagers for two-color speckle and fast natural-seeing imaging
- Simultaneous two-color diffraction-limited optical imaging (FWHM~0.02" at 650 nm) of targets as faint as V~17 over a 6.7"
- 1024x1024 full frame readout of 26 times per second (or more if subarrays are used)
- Wide-field natural seeing mode provides simultaneous two-color imaging in standard SDSS filters over a 60" FOV

Learn more about instrument capabilities at: ***http://www.gemini.edu/caps-instr***

# Expanding Flexibility
## *New Proposing and Observing Modes*

Learn more about Gemini's observing modes at:
http://www.gemini.edu/caps-modes

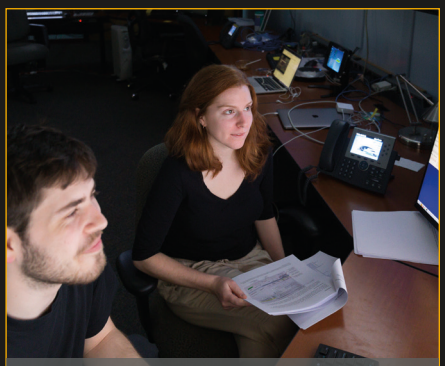
## Fast Turnaround Programs

The Fast Turnaround program accepts proposals for both telescopes. Proposals are solicited each month and reviewed by other proposers during that round. Graduate students may review proposals with a PhD PI or Co-I designated as a "mentor". PIs are notified within three weeks of the outcome, and accepted programs are observed within one to four months of initial proposal submission.

This innovative mode uses up to 10% of the available observing time at each telescope. Your feedback will continue to improve our process.




*H. Dahle, M. D. Gladders, K. Sharon, M. B. Bayliss, J. R. Rigby*



*GOGREEN PV Observers*

## Priority Visitor Observing Mode

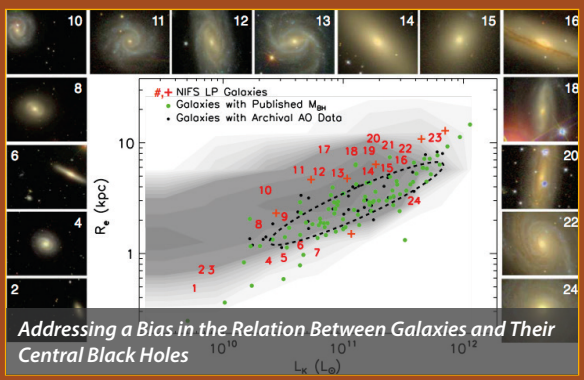
Priority Visitor (PV) observing mode allows Band 1 PIs (or team members) to visit Gemini prepared to observe their program if the conditions are as good as (or better than) required. If not, the PI will execute other approved queue programs. Any unobserved portions of the PI's program can then be executed within the regular queue. PV mode is the default for Band 1 Large/Long programs and may also be requested by other PIs.

http://www.gemini.edu/caps-pv

## Large and Long Programs

Large and Long Programs occupy up to 20% of Gemini observing time of the participating partners (United States and Canada). These programs require significantly more time than is typically approved for a single program, or extend over two to six semesters, or both. PIs must be based in an institution of one of the participating countries, but there is no restriction on Co-Investigator affiliations.

The annual announcement of opportunity is issued late each year, with Letters of Intent due in early February and proposals due in early April, for observations to begin in the subsequent B semester.




*Addressing a Bias in the Relation Between Galaxies and Their Central Black Holes*



*'Alopeke installation*

## Gemini Welcomes Visiting Instruments

Visiting Instruments expand the capabilities we offer to all users. Outstanding results have been produced by instruments such as GRACES, 'Alopeke, Zorro, Phoenix, TEXES and IGRINS. We offer new and exciting capabilities almost every semester, so remember to check the call for proposals (available at the end of February and August each year) to see what new instruments you can use for your science, and if you have an instrument you would like to bring to Gemini, contact us at gemini-vip@gemini.edu.

*The Gemini Observatory is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), under a cooperative agreement with the National Science Foundation (NSF) on behalf of the Gemini Partnership.*

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