

Some Lessons Learned from Ground-based Telescope Operations

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ESO Deputy Director for Science



Synergies with



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Co-Chair: David Hatzidimitriou

Chair: Tom L. Wilson
Co-Chair: David Ellner

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Co-Chair: Peter Schuecker

Chair: Catherine Turon
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SCIOPS 2013
 An ESA/ESO conference
 Working Together in Support of Science
 17-20 Oct 2013
 ESAC, Madrid

The objective of SCIOPS 2013 is to present and discuss the various approaches to science operations and ground-based facilities in Astronomy and Space Science domains.

SCIOPS 2015
 Science Data Management
 An ESO/ESA Workshop
 Working Together in Support of Science
 24-27 November 2015
 ESO, Garching bei München, Germany

The objective of SCIOPS 2015 is to present and discuss the various approaches to science data management and operations research and open ground-based facilities for Astronomy.

Scientific publications: [astro-ph/1508014](#)

Workshop website: [http://sciops.eso.org](#)

Workshop contact: sciops@eso.org

SCIOPS 2017
 Working together in support of science
 17-20 Oct 2017
 ESAC - Madrid

Distributed science operations
 The objective of SCIOPS 2017 is to explore the various approaches to science operations and ground-based facilities for Astronomy.

Programme Organising Committee
 Christa Hainaut (ESO)
 Rosalind Sutherland (ESO)
 Andrew Butler (ESO)
 Jens Lorenz (ESO)
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 Markus (Markus) Trögl (ESO)
 Dennis (Dennis) M. (ESO)
 Tim (Tim) (ESO)

Workshop website: [http://sciops.eso.org](#)

Workshop contact: sciops@eso.org

Anecdotes from





Maunakea
since 1999

Gemini Observatory:
Operating two twin 8m telescopes
on Maunakea and Cerro Pachón:
providing access to the entire sky



Hilo, Hawaii



We are Here



We are Here

We are Here

We are Here We are Here

We are Here

Cerro Pachon
since 2000

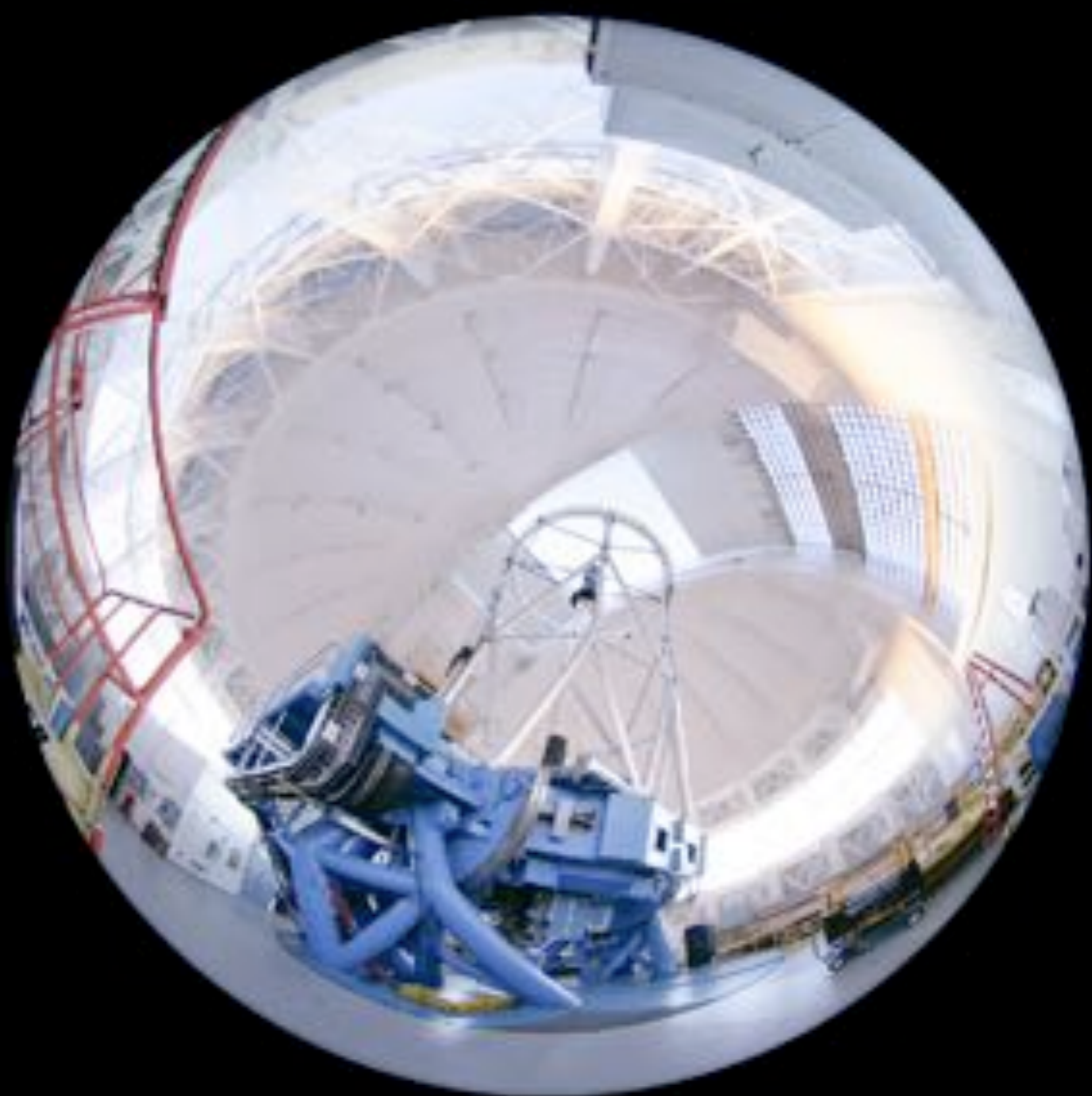


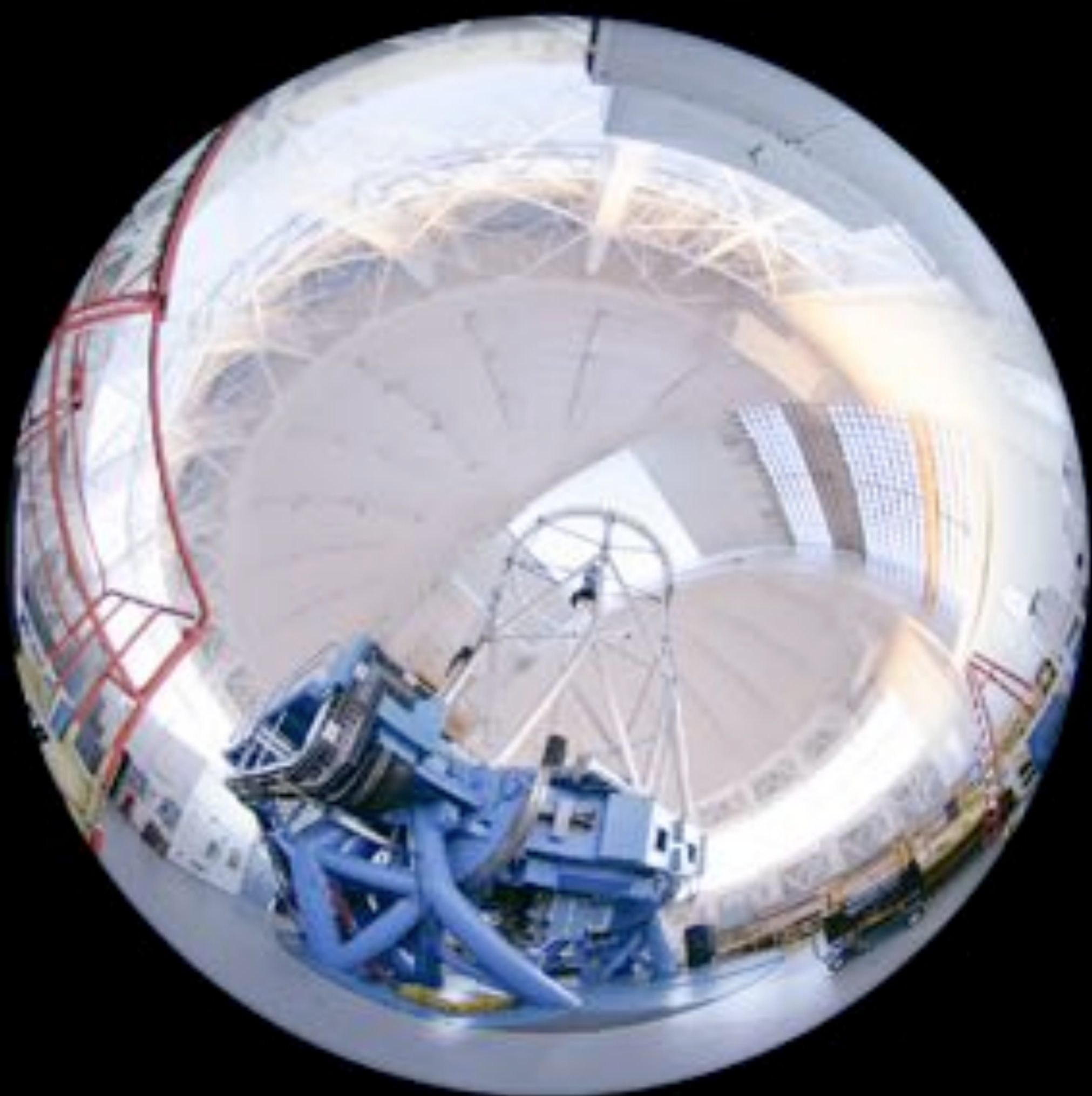
La Serena, Chile











Gemini Lessons Learned

Operations (and instrumentation)
shall be driven by users' science
(not the other way around...)

Instrumentation

Instrumentation

Site	Instrument		FoV, Mode, Resolution	AO Support
Gemini-N up to 2018	GMOS-N	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(ALTAIR)
	NIRI	1-5 μm	img 20"x20" - 120"x120"	ALTAIR
	NIFS	950-2400 nm	IFS (3"x3") R:5000	ALTAIR
	GNIRS	1-5 μm	LS R:1,800-18,000 (+img)	ALTAIR
Gemini-S GN in 2018	GMOS-S	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(GeMS)
	GSAOI	950-2400 nm	img 85"x85" with MCAO	GeMS
	FLAMINGOS-2	950-2400 nm	img 6.1' ∅ LS, (MOS) (2'x6') R: 1,200-3,000	(GeMS)
	GPI	900-2400 nm	IFU 2.8"x2.8" contrast: 10 ⁷ at 0.4"	XAO
~2018	GHOST (GS)	360-1000 nm	2 IFUs in 7' ∅ R: 50,000 + 75,000	(None)
~2022	Gen4#3 (GS)	Visible + NIR	aimed to be an LSST follow-up instrument	

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Gemini-N up to 2018	GMOS-N	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(ALTAIR)
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Gemini-S GN in 2018	GMOS-S	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(GeMS)
	GSAOI	950-2400 nm	img 85"x85"	GeMS
	FLAMINGOS-2	950-2400 nm	img 85"x85" IFS (3"x3") R: 1,200-3,000	(GeMS)
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Strategic Instruments

Instrumentation

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Gemini-N up to 2018	GMOS-N	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(ALTAIR)
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	NIFS	950-2400 nm	IFS (3"x3") R:5000	
	GNIRS	1-5 μm	LS R:1,800-18,000 (+img)	
Gemini-S GN in 2018	GMOS-S	360-940 nm	img 5.5'x5.5' LS, MOS	(GeMS)
	GSAOI	950-2400 nm	img 85"x85"	GeMS
	FLAMINGOS-2	950-2400 nm	img 85"x85" R: 1,200-3,000	(GeMS)
	GPI	900-2400 nm	IFS contrast: 10 ⁷ at 0.4"	XAO
~2018	GHOST (GS)	360-1000 nm	2 IFUs in 7' ∅ R: 50,000 + 75,000	(None)
~2022	Gen4#3 (GS)	Visible + NIR	aimed to be an LSST follow-up instrument	
Visitor INS	TEXES (GN)	5-25 μm	LS R: 4,000 - 85,000	no AO
	DSSI (GN/GS)	400-1000 nm	Dual EMCCD imaging, 20 mas resolution@650nm	speckle
	GRACES (GN)	~500-1000 nm	see CFHT/ESPaDOnS - high-res. spectrograph	no AO
	Phoenix (GS)	1-5 μm	LS R: 50,000 - 80,000	no AO
	POLISH2 (GN)	optical	high precision polarimetry	no AO
	2017 NICI	1-5 μm	coronagraphic imager	AO built-in
	2018 HIPPI (TBC)	optical	high precision polarimetry	no AO
	2018 IGRINS (GS)	H+K	LS R: 40,000	no AO
	2018 (TBC) TIKI (GS)	mid-IR	high-contrast, mid-infrared planet imager	own XAO
	2019 (TBC) MAROON-X (TBC)	500-1000 nm	precision radial velocity (~1 m/s)	no AO
2020 (TBC) G-IRMOS (GS)	IR	deployable IFUs	GeMS	
2020 (TBC) BATMAN (TBC)	optical / NIR	multi-mirror MOS	GeMS	

Strategic Instruments

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Gemini-S GN in 2018	GMOS-S	360-940 nm	img 5.5'x5.5' LS, MOS	(GeMS)	
	GSAOI	950-2400 nm	img 85"x85"	GeMS	
	FLAMINGOS-2	950-2400 nm	img (5"x5") R: 1,200-3,000	(GeMS)	
	GPI	900-2400 nm	IFS contrast: 10 ⁷ at 0.4"	XAO	
~2018	GHOST (GS)	360-1000 nm	2 IFUs in 7' ∅ R: 50,000 + 75,000	(None)	
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	GRACES (GN)	~500-1000 nm	see CFHT/ESPaDOnS - high-res. sp	AO	
	Phoenix (GS)	1-5 μm	LS R: 50,000 - 80,000	no AO	
	POLISH2 (GN)	optical	high precision	no AO	
	2017	NICI	1-5 μm	core	AO built-in
	2018	HIPPI (TBC)	optical	astrometry	no AO
	2018	IGRINS (GS)	H+K	R: 10,000	no AO
	2018 (TBC)	TIKI (GS)	mid-IR	high-contrast, mid-infrared planet imager	own XAO
	2019 (TBC)	MAROON-X (TBC)	500-1000 nm	precision radial velocity (~1 m/s)	no AO
2020 (TBC)	G-IRMOS (GS)	IR	deployable IFUs	GeMS	
2020 (TBC)	BATMAN (TBC)	optical / NIR	multi-mirror MOS	GeMS	

Strategic Instruments

Tactical Instruments

Operations

Peer review
Time allocation

Proposal

Program
preparation

Observations

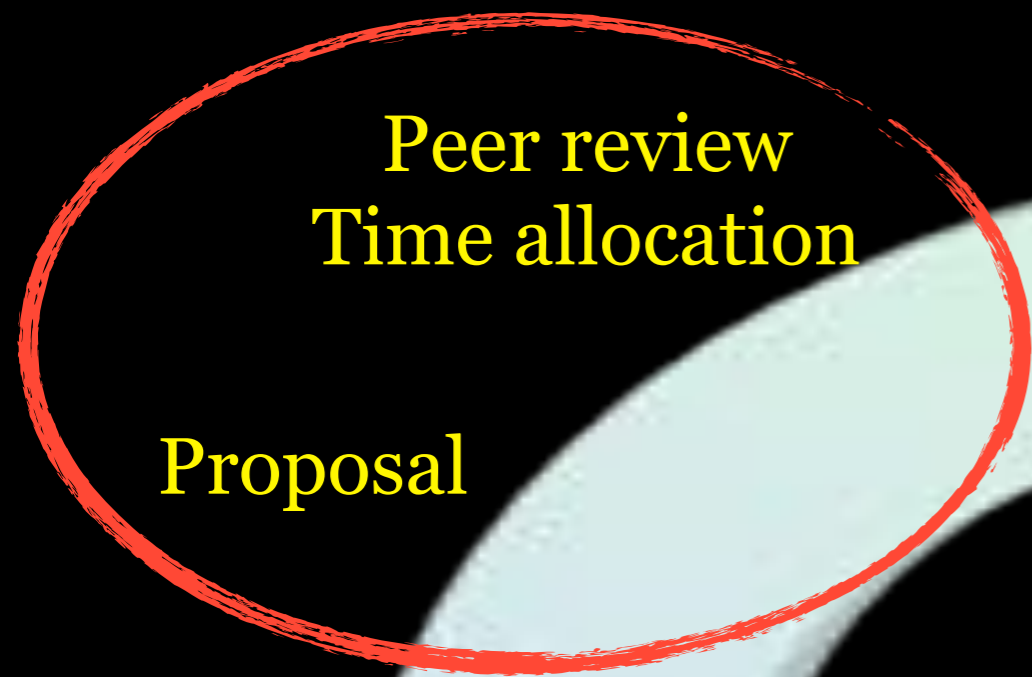
Quality
control

Archiving

Data reduction

Data analysis





Program
preparation

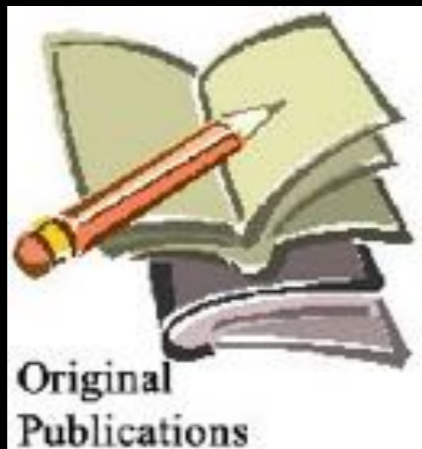
Observations

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Proposing for time at Gemini

The regular proposal: *once per semester*, through the national Time Allocation Committees (TAC)

for regular proposals
(oversubscription: <2)

Large & Long Programs: *once per year*, through the Large Program TAC

for large and/or long **ambitious** proposals
(oversubscription: >5)

Fast turnaround programs: *once per month*, peer reviewed, no TAC

for short, rapid, immediate and/or follow-up proposals
(oversubscription: ~3)



Peer review
Time allocation

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Observing at Gemini

Queue mode: (opening the time domain)

You submit your observations, we observe for you

You can look over our shoulders by *Eavesdropping!*



Classical mode: (allowing real-time decision)

You visit the observatory and conduct your observations



First 'BOGO', Allison Noble (U.Toronto), at Gemini South

Priority Visitor Observing:

as long as you want and chose & pick the best time for your observations!



Bring One, Get One free: If you come observing and bring your student, we will pat for her/him



Observing at Gemini

Base Facility Operations (no person at the summit)
started at Gemini North in November 2015



and at Gemini South in November 2016

Peer review
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Data Reduction / User Forum

Gemini provides data reduction tools for all instruments; available through the easy to install, python/pyraf based package (developed with STScI)



The User Forum:

<http://drforum.gemini.edu>

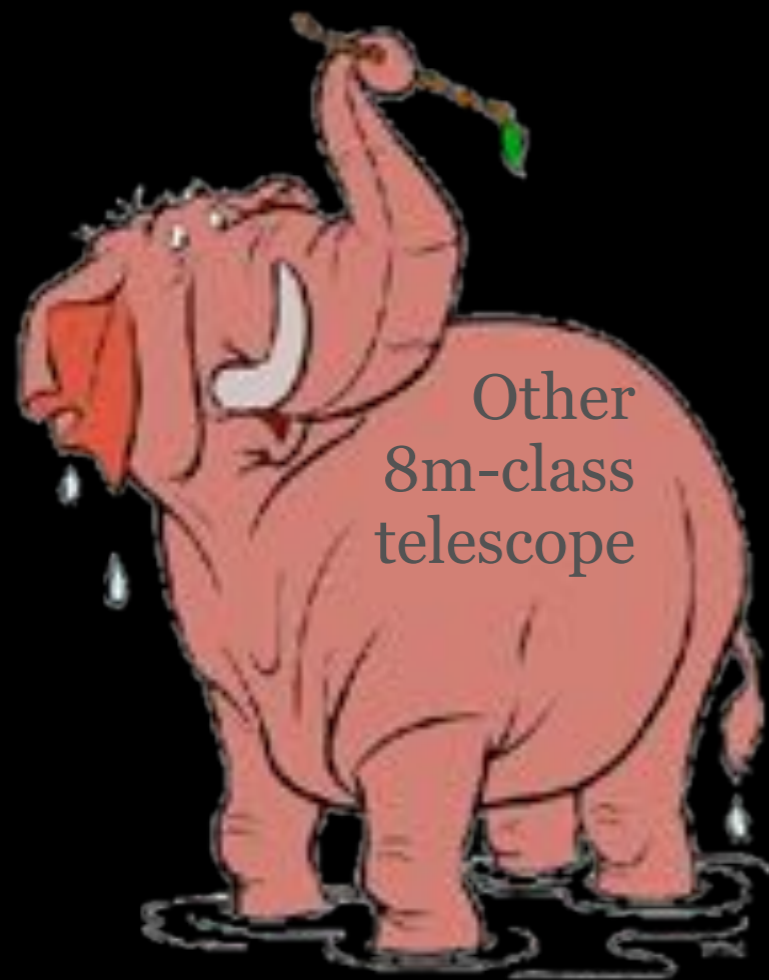


Purpose: Trading ideas, scripts, and best practices

New: Care and feeding to promote more usage

Gemini Board's guidelines for 2016-2021:

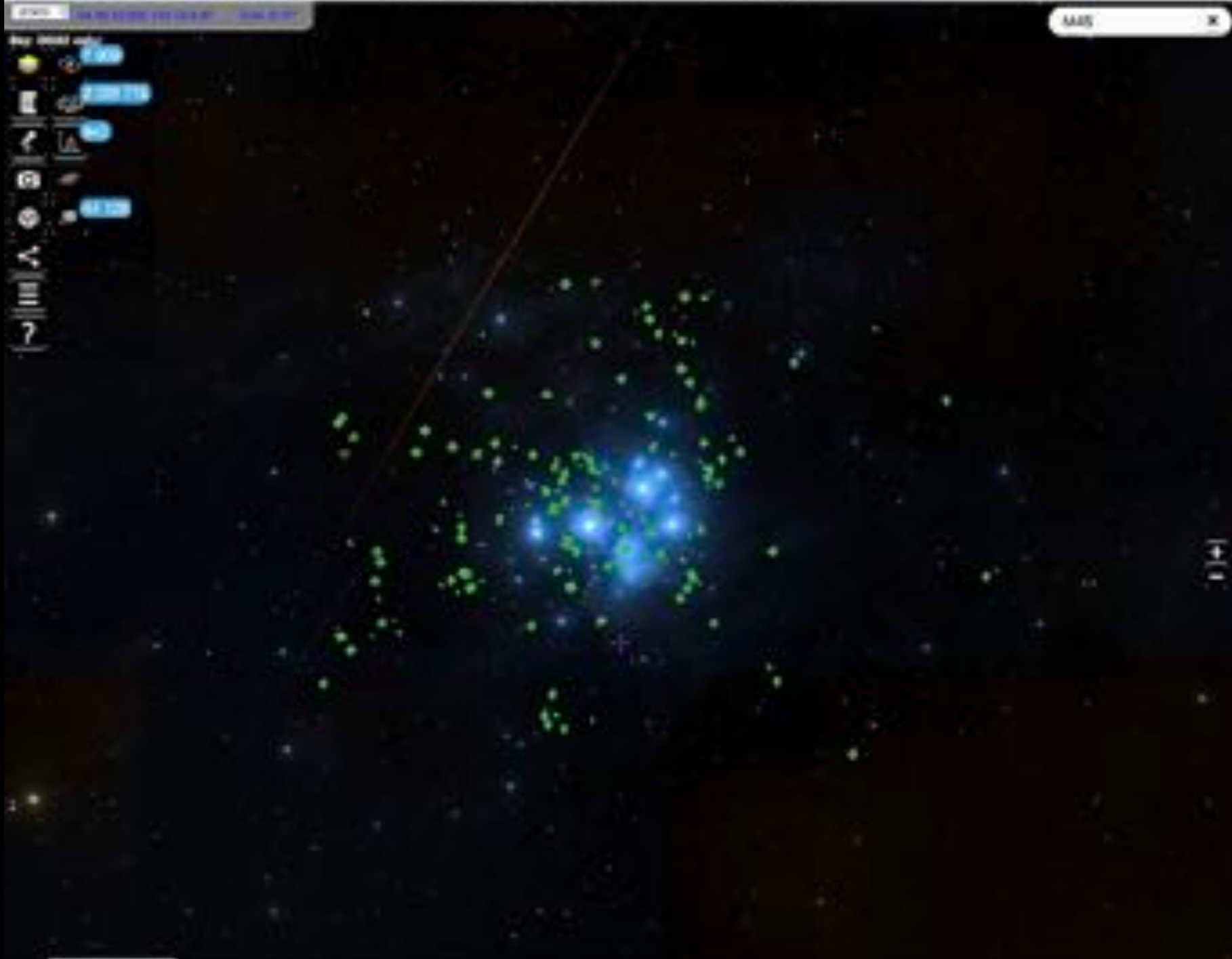
“Gemini will strive to be the best observatory in the world for the execution of flexible, innovative, and efficient science programs”



Gemini Board's guidelines for 2016-2021:

"Gemini will strive to be the best observatory in the world for the execution of flexible, innovative, and efficient science programs"

Data Archiving / Data Mining



RA (J2000)	DEC (J2000)	RA (J2000)	DEC (J2000)	Target name	Instrument	Collection	Title	Start Time	Duration (s)
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090 (NGC 6090)	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100
01: 29: 26.33333333	00: 00: 00.00000000	01: 27 30.7	00: 00: 00.00000000	NGC 6090	SDSS	-R	NGC 6090	2010-01-27 00:00:00	100

1200 Observations in the chosen area

Gemini Observatory Archive

Home About Help Files Not logged in

P/Cel Name: (no punctuation, separate with spaces)
 Program ID: (or Obs. ID/Date Label/Event Name)
 UTC Date: (YYYYMMDD or start - end)
 Instrument: (Select DACE for DACE-A and DACE-B)
 Obs. Class: (Feed)
 Obs. Type: (Feed)
 Mode: (Imaging/Spectroscopy/etc)
 Adaptive Optics: (Feed)

Program Title: (no punctuation, separate with spaces)
 Target Name: (Name of target)
 Position: RA: Dec: (J2000.0 or decimal degrees)
 Search radius: (arcsec or decimal degrees)
 See / Reduced: (Select data by processing state)

Advanced Options + (click to show / hide) Column Selection + (click to show / hide)

Search: (Help on Filtering)

WARNING: Your search does not constrain the number of results - as you did not specify a date, date range, program ID etc. Searches like this are limited to 250 results, and the search hit that limit. Calibration association will not be available. You may want to constrain your search. Constrained searches have a higher result limit.

Key: [P] to preview an image of the data in your browser, [D] to download that one file, [A] to see program Abstract and P/Cel details, [L] to see observing Log entries. Use the check boxes to select a subset of the results to download, or if available a download all link is at the end of the table. Click the filename to see the full header in a new tab. Click anything else to add that to your search criteria. You can also [sort these results as JCR](#).

Download	Filename	Date Label	UT Date Time	Inst	Class	Type	Object	Waveband	ExpT	SN	
<input type="checkbox"/>	N01710380028.Fe	06	06-20-09-03-05-100-008	0670	astroCel	26.8CT	HP17704	SL_w4600	1.000	10.00	Unfiltered
<input type="checkbox"/>	N01710380027.Fe	06	06-20-09-03-05-100-007	0670	astroCel	26.8CT	HP17704	SL_w4600	1.000	10.00	Unfiltered
<input type="checkbox"/>	N01710380026.Fe	06	06-20-09-03-05-100-006	0670	astroCel	26.8CT	HP17704	SL_w4600	1.000	10.00	Unfiltered
<input type="checkbox"/>	N01710380025.Fe	06	06-20-09-03-05-100-005	0670	astroCel	26.8CT	HP17704	SL_w4600	1.000	10.00	Unfiltered
<input type="checkbox"/>	N01710380024.Fe	06	06-20-09-03-05-100-004	0670	astroCel	26.8CT	HP17704	SL_w4600	1.000	10.00	Unfiltered
<input type="checkbox"/>	N01710380023.Fe.mpl	06 SL	06-20-09-03-05-100-003	0670	astroCel	26.8CT	HP17704	SL	0.00	10.00	Unfiltered
<input type="checkbox"/>	N01710380022.Fe	06	06-20-09-03-05-100-002	0670	astroCel	26.8CT	HP17704	ND1000000	0.00	10.00	Feed
<input type="checkbox"/>	N01710380021.Fe	06	06-20-09-03-05-100-001	0670	astroCel	26.8CT	HP17704	ND1000000	0.00	10.00	Feed
<input type="checkbox"/>	N01710380020.Fe	06 SL	06-20-09-03-05-100-000	0670	astroCel	26.8CT	HP17704	ND1000000	0.00	10.00	Feed
<input type="checkbox"/>	N01710380019.Fe	06	06-20-09-03-05-100-000	0670	astroCel	26.8CT	HP17704	SL	0.00	10.00	Feed

New cloud-based archive, hosted by 'Amazon web services'



archive.gemini.edu

Conclusions

Science Operations

Rethinking periodically is useful

Dare to break out of the routine

Think out of the box

It is fun

User love it

Thank You !

