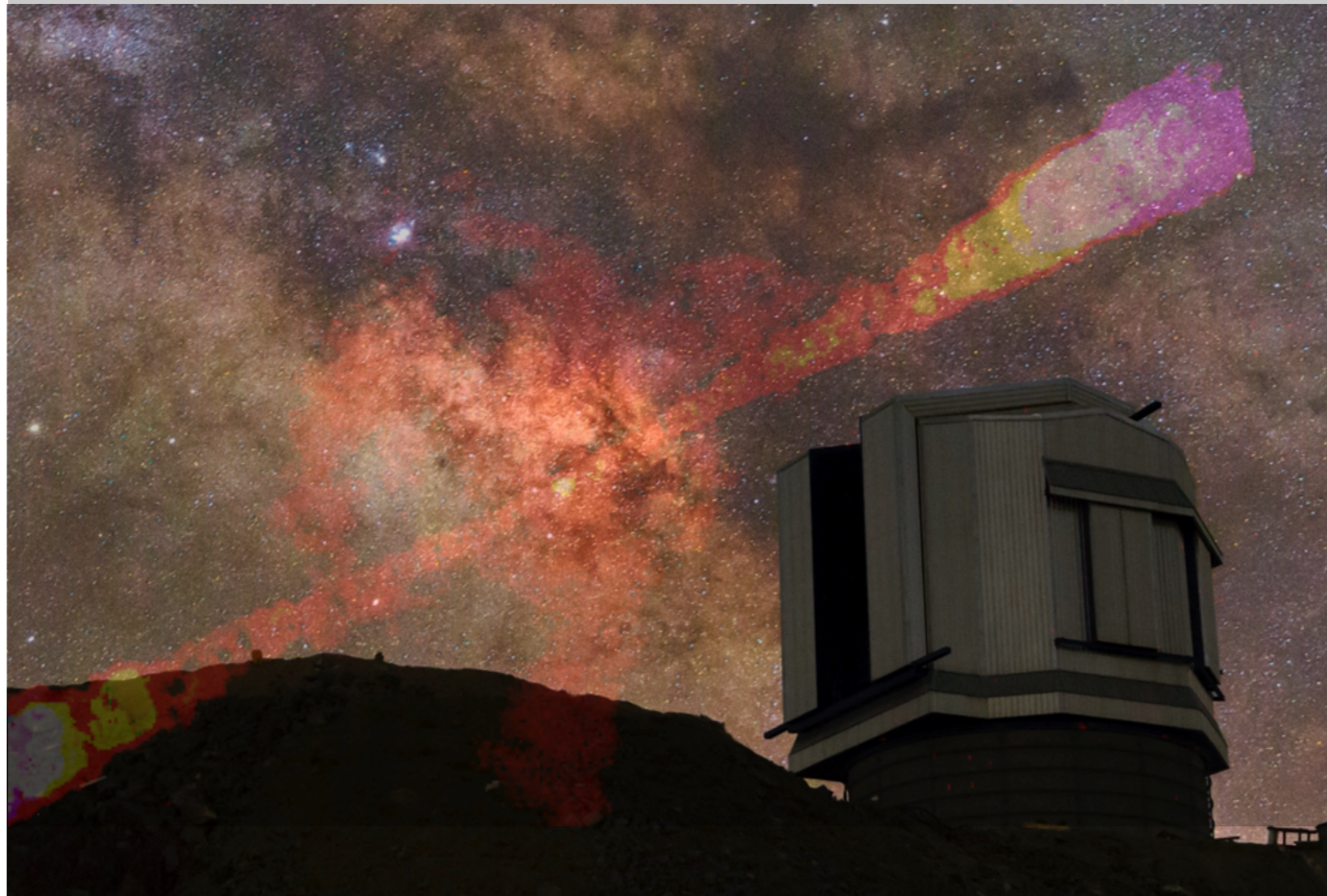


Detectability of GRB Optical Prompt and Afterglow with Iranian National Telescope



Soroush Shakeri

Isfahan University of Technology (IUT)

2nd Astro-COLIBRI multi-messenger
astrophysics workshop

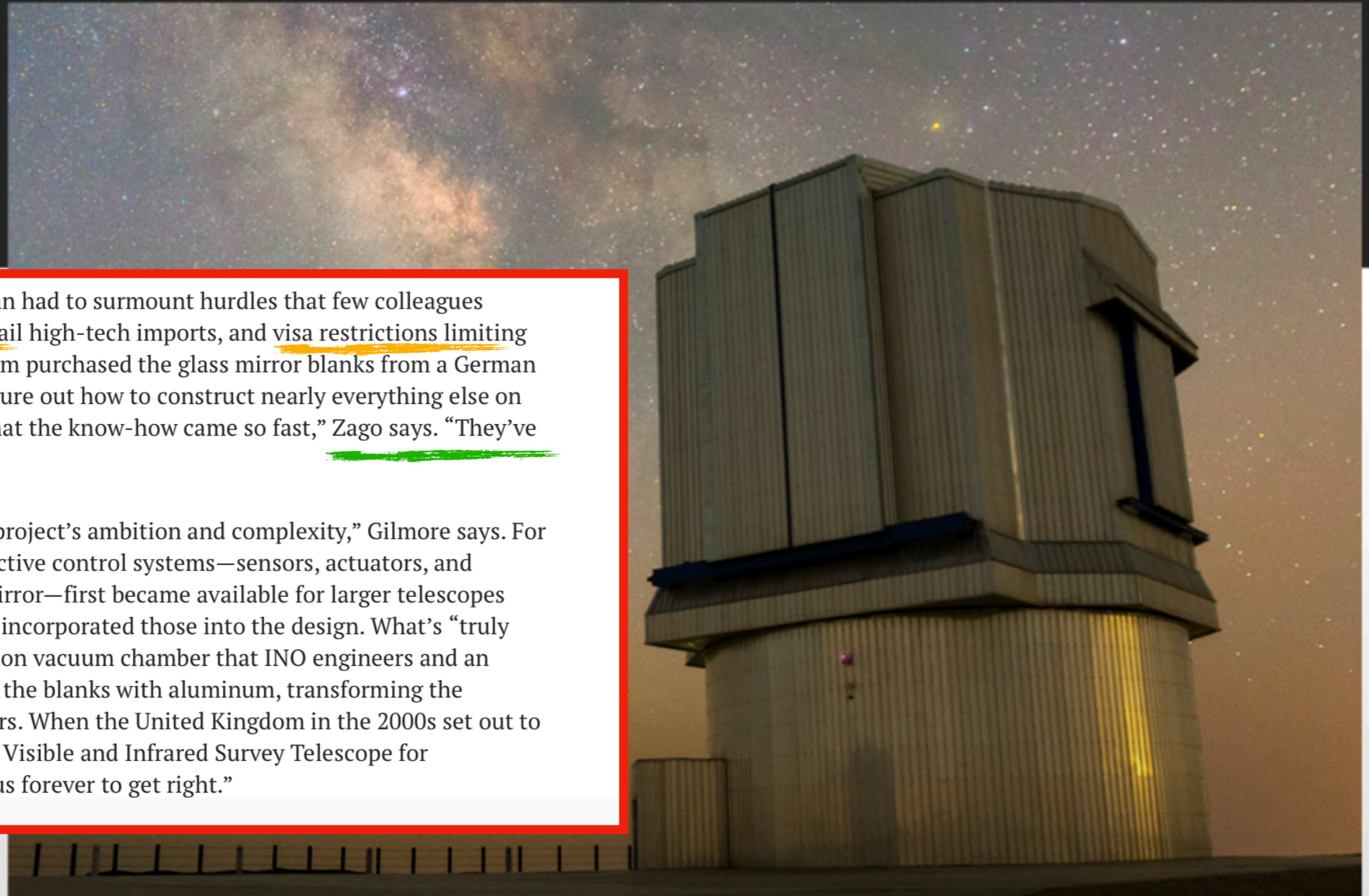
HOME > NEWS > SCIENCEINSIDER > 'THE DOOR IS OPEN': IRANIAN ASTRONOMERS SEEK COLLABORATIONS FOR THEIR NEW, WORLD-CLASS TELESCOPE

SCIENCEINSIDER | ASIA/PACIFIC

'The door is open': Iranian astronomers seek collaborations for their new, world-class telescope

The 4-meter Iranian National Observatory, which faced long odds, released its first images today

19 OCT 2022 • 4:20 PM • BY [RICHARD STONE](#)



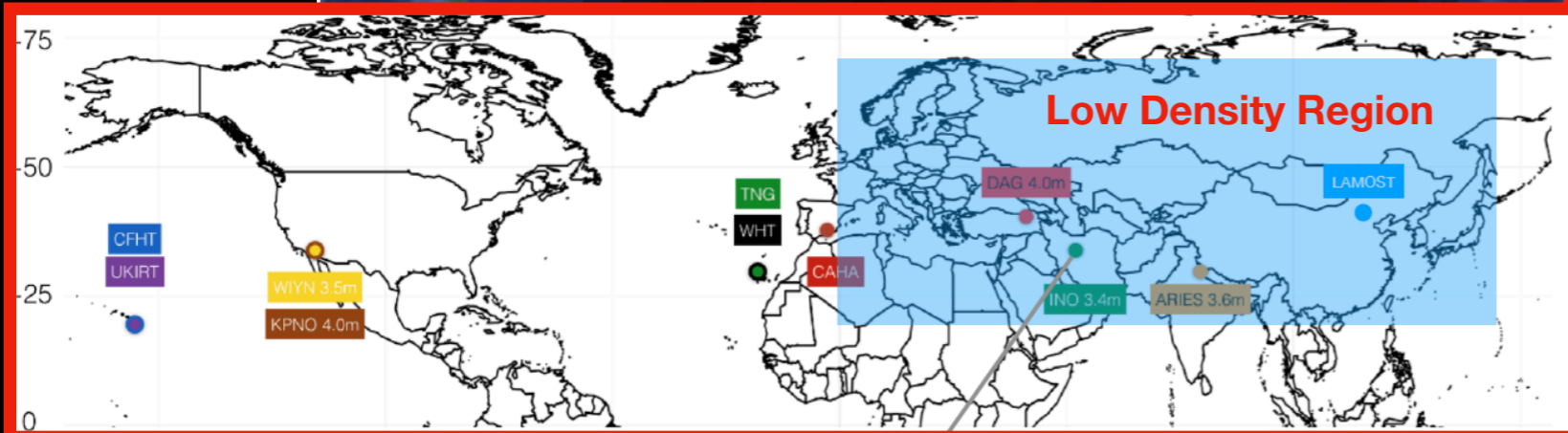
In building INO, astronomers in Iran had to surmount hurdles that few colleagues elsewhere face: sanctions that curtail high-tech imports, and visa restrictions limiting their travel abroad. The Iranian team purchased the glass mirror blanks from a German firm. INO engineers then had to figure out how to construct nearly everything else on their own. “What surprises me is that the know-how came so fast,” Zago says. “They’ve been working like hell!”

“At every stage they increased the project’s ambition and complexity,” Gilmore says. For example, he says, when so-called active control systems—sensors, actuators, and software that position a primary mirror—first became available for larger telescopes about a decade ago, INO engineers incorporated those into the design. What’s “truly astonishing,” Zago says, is a precision vacuum chamber that INO engineers and an Iranian company fashioned to coat the blanks with aluminum, transforming the polished glass into telescope mirrors. When the United Kingdom in the 2000s set out to build an aluminizing system for its Visible and Infrared Survey Telescope for Astronomy, Gilmore says, “it took us forever to get right.”

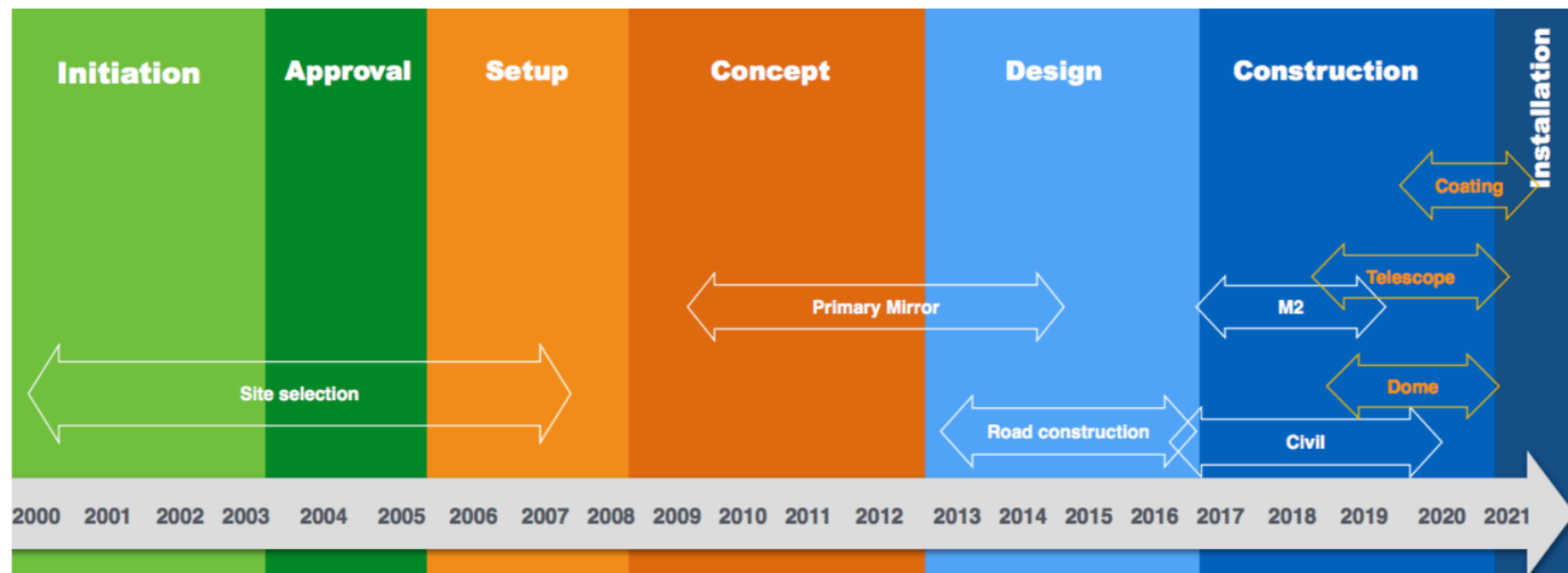
The Distribution of Optical Telescopes All Over the Globe

Science

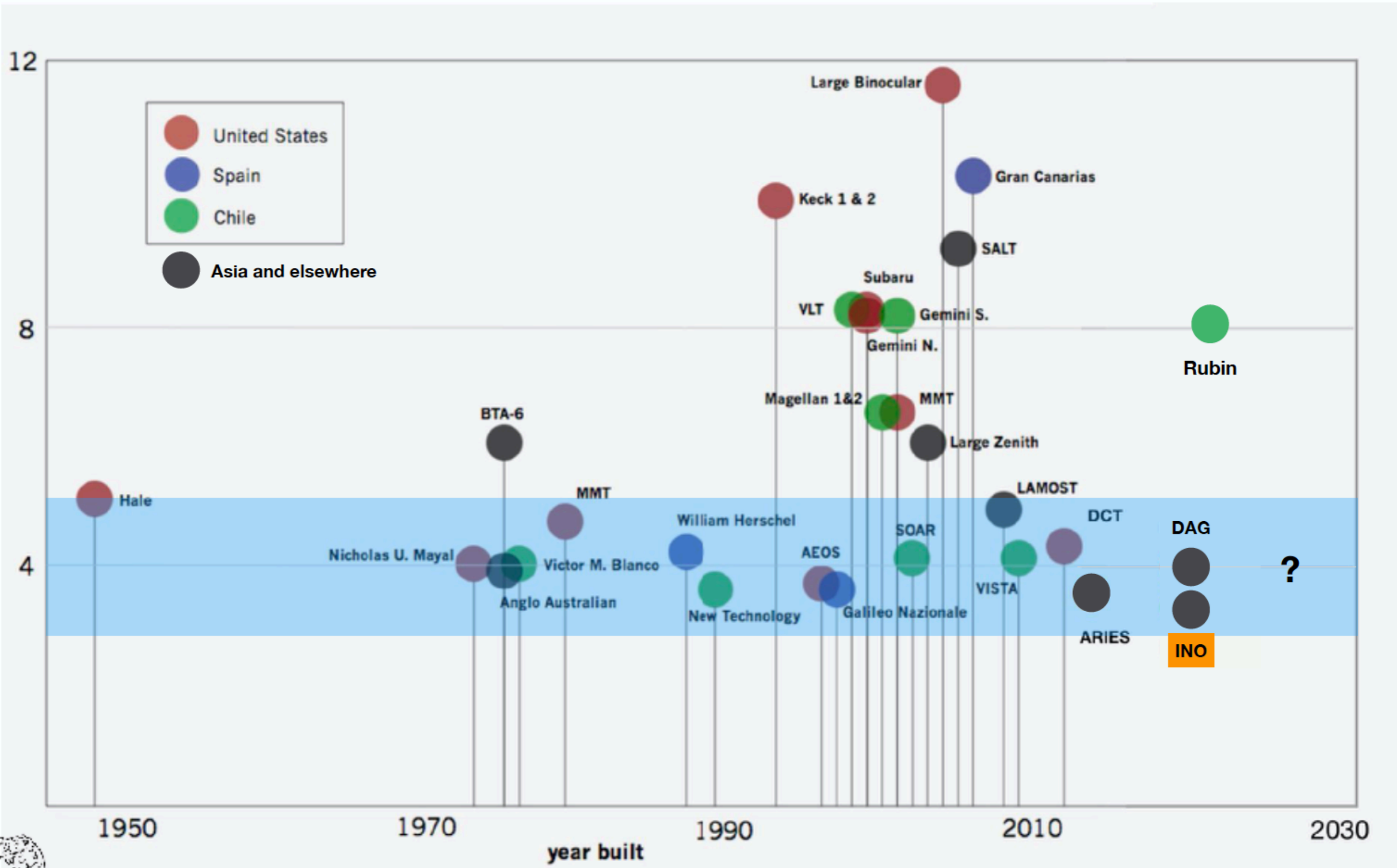
evolution, and hunting for exoplanets. The Iranian observatory and two others in the region—a 4-meter infrared telescope in Turkey nearing completion and a 3.6-meter optical telescope in India—fill a geographic gap in a global network that keys in on fleeting phenomena such as gamma ray bursts to try to pinpoint their locations and unravel their physics. “You need a chain of telescopes all around the world to follow up,” Gilmore says.

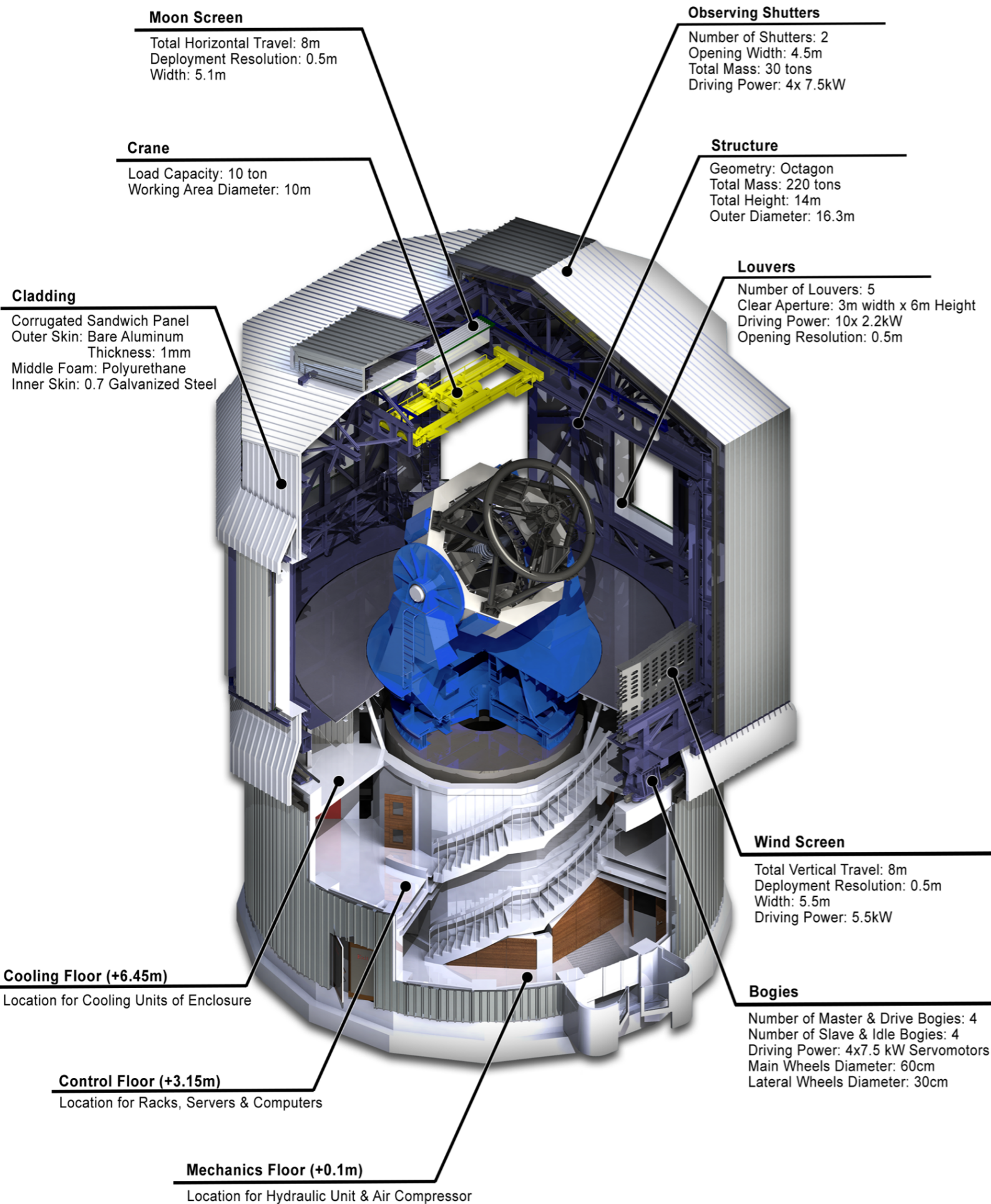


Design - Construction - Installation

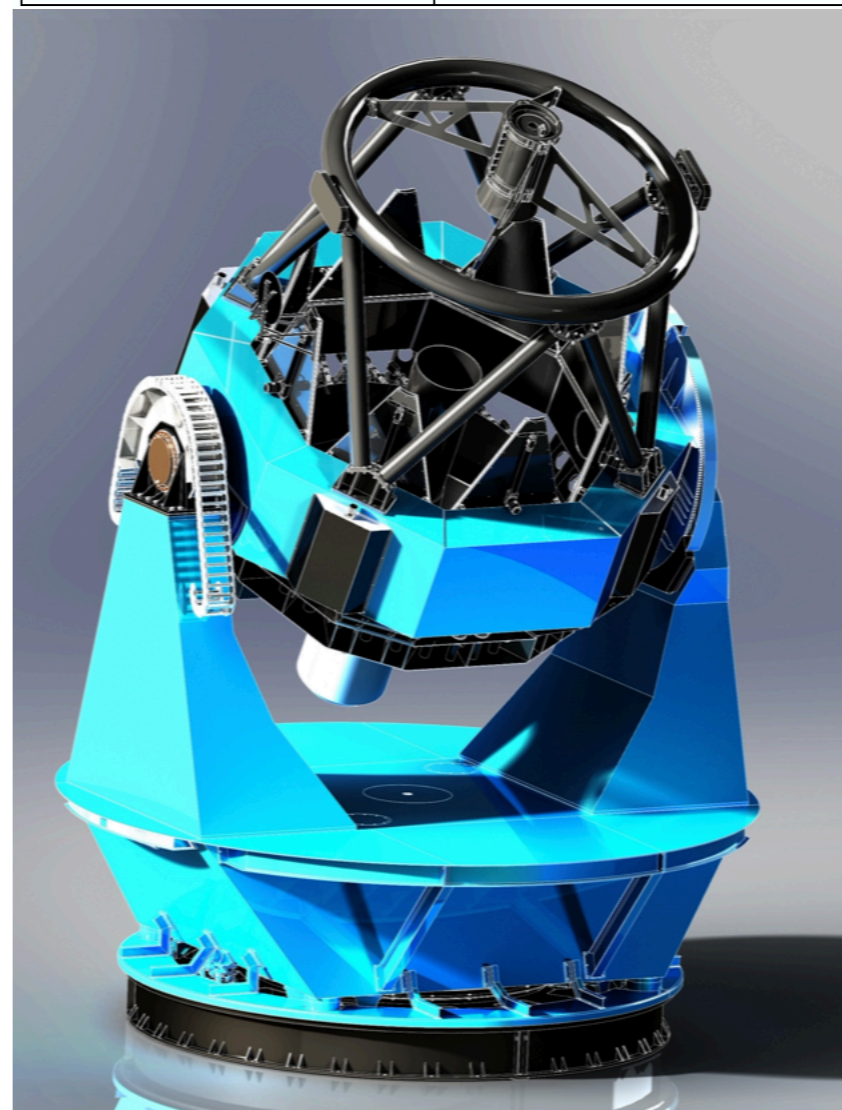


4m Class Telescopes





Optics	Ritchey-Chrétien
Wavelength	325-2500 nm
M1 diameter	3400/700 mm
M1 f-ratio	f/1.5
Telescope f-ratio	f/11.36
Mount	Alt-Az
Guided tracking accuracy	0.2 arcsec
Field of view	8-20 arcmin
Structure weight	90 T

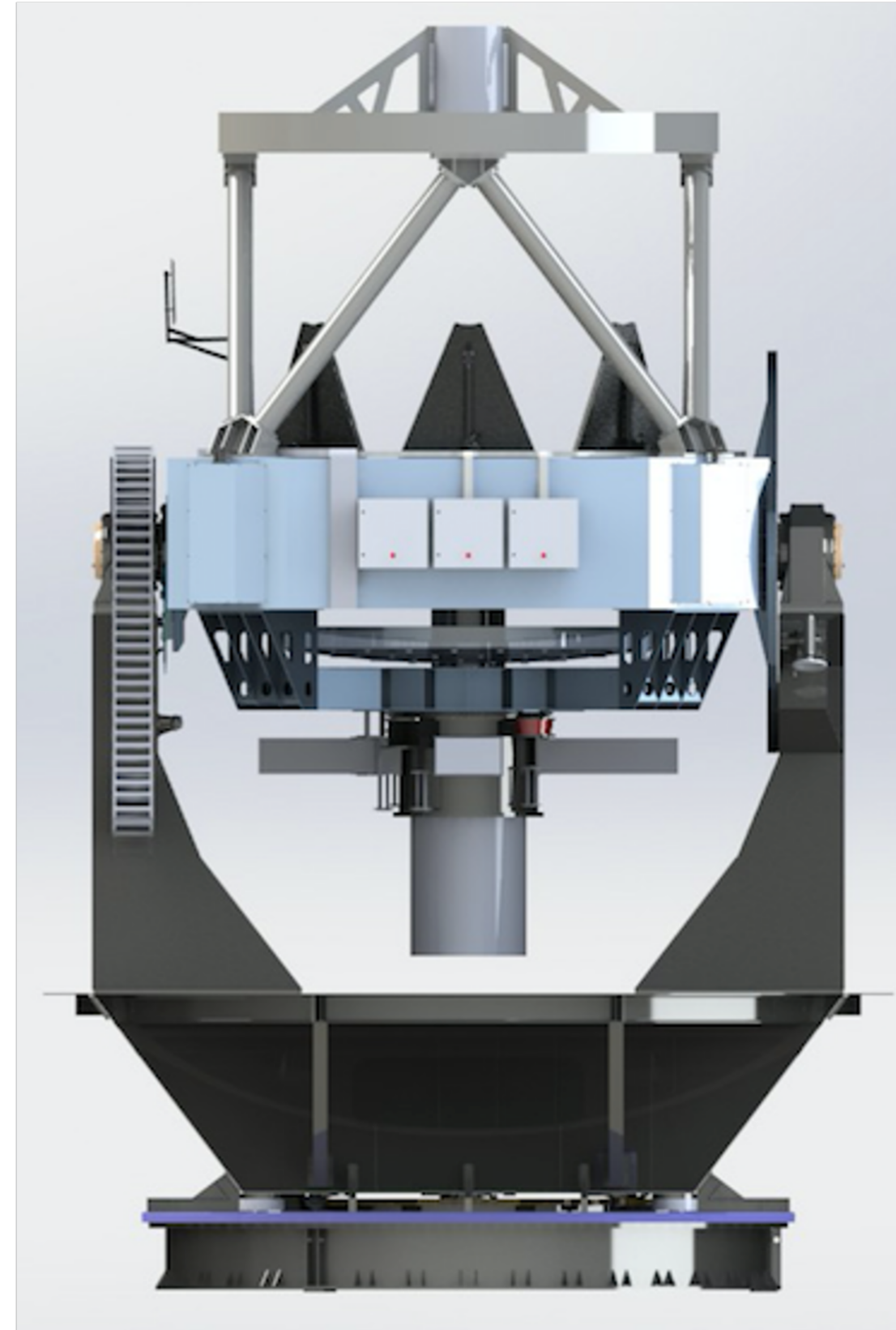
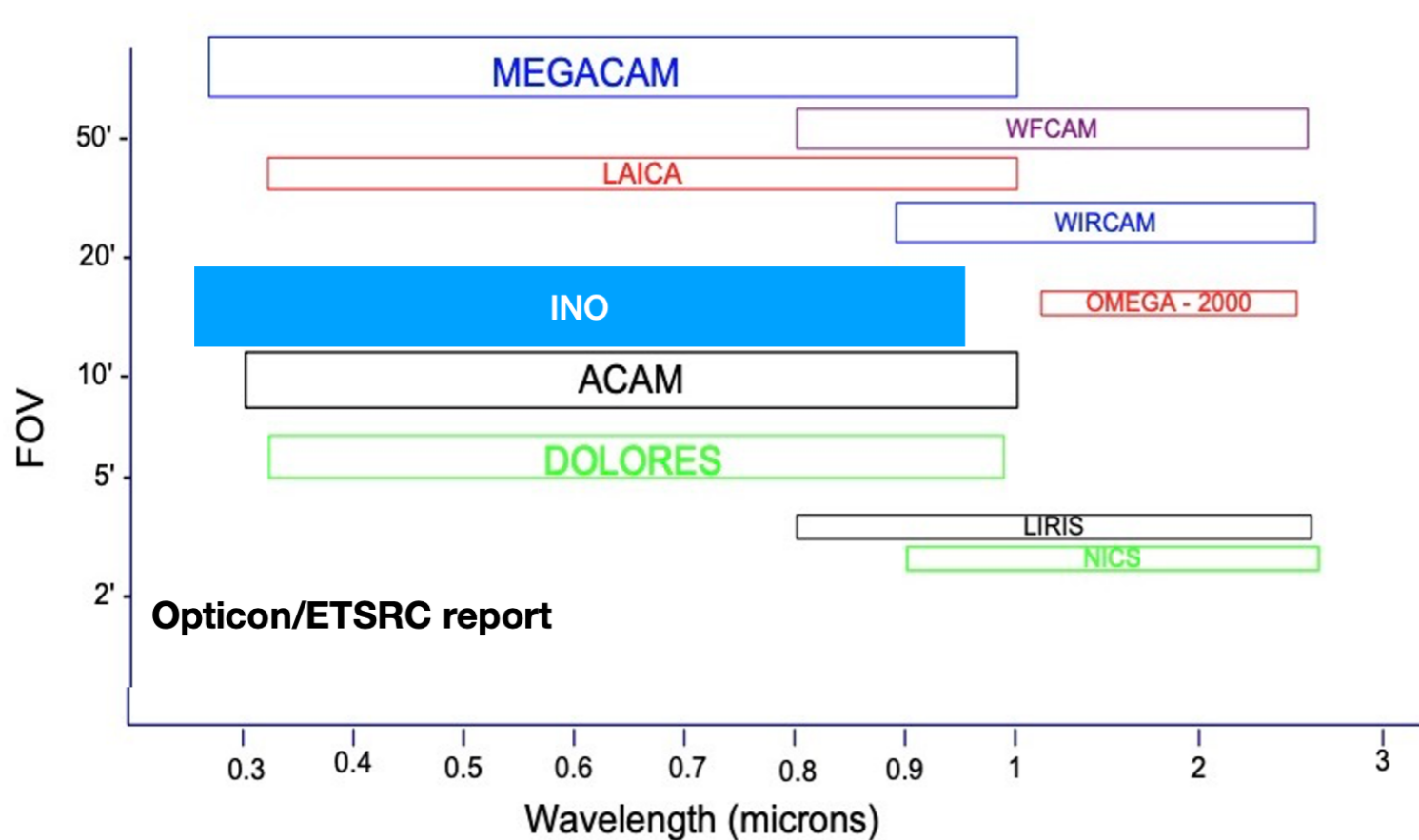


Instrumentation

Phase I:
Commissioning Camera 

Phase II:
Imaging camera (FoV 4 arcmin) 
Medium/Low resolution Slit Spectrograph [TO BE CONTINUED]

 **Phase III:**
Wide field Imaging camera (FoV 20 arcmin)
Multi-object / IFU spectrograph



Iranian National Observatory (INO)



<https://ino.org.ir/en/>



Observatory Site

Suitable location in northern hemisphere



Activities of Iranian National Observatory



ACTIVITIES

Construction of the INO340 Telescope The



TECHNOLOGY

In line with the envisioned role of the INO



OUR STORY

INO scientists selected Mount Garrash in

First Light in 2021

ARP282 (mag 12.4, 319 Mly)

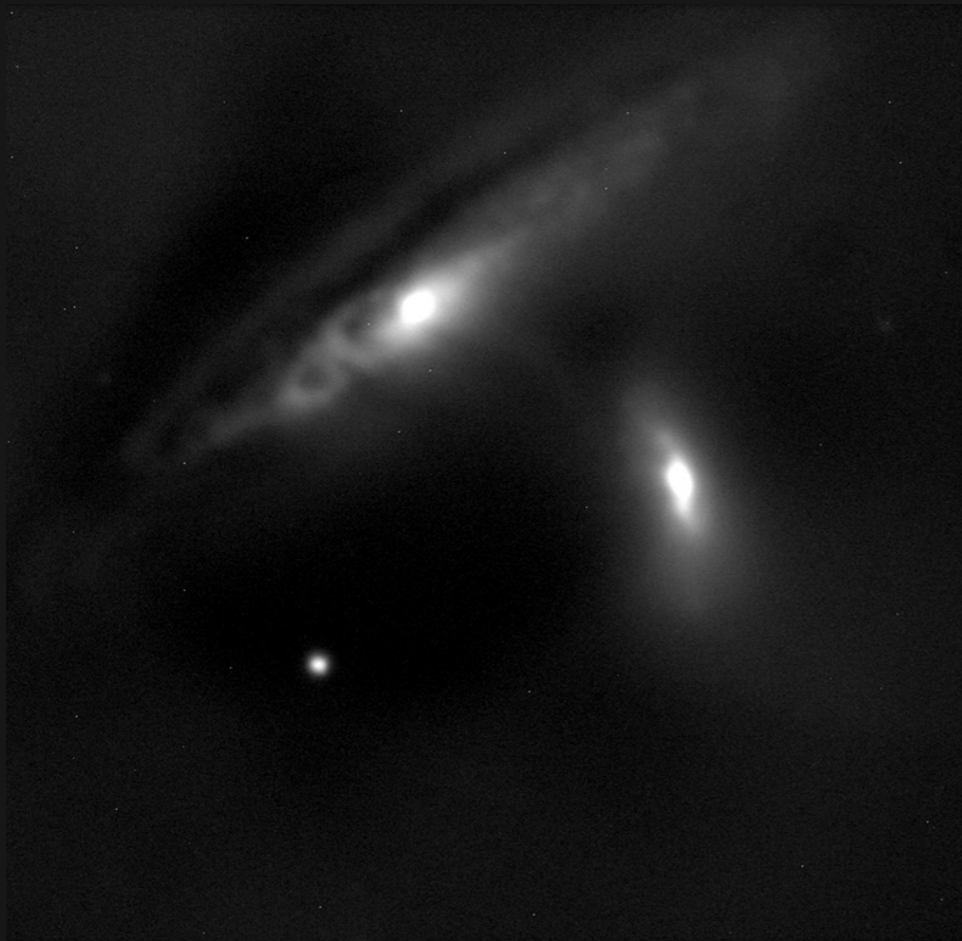
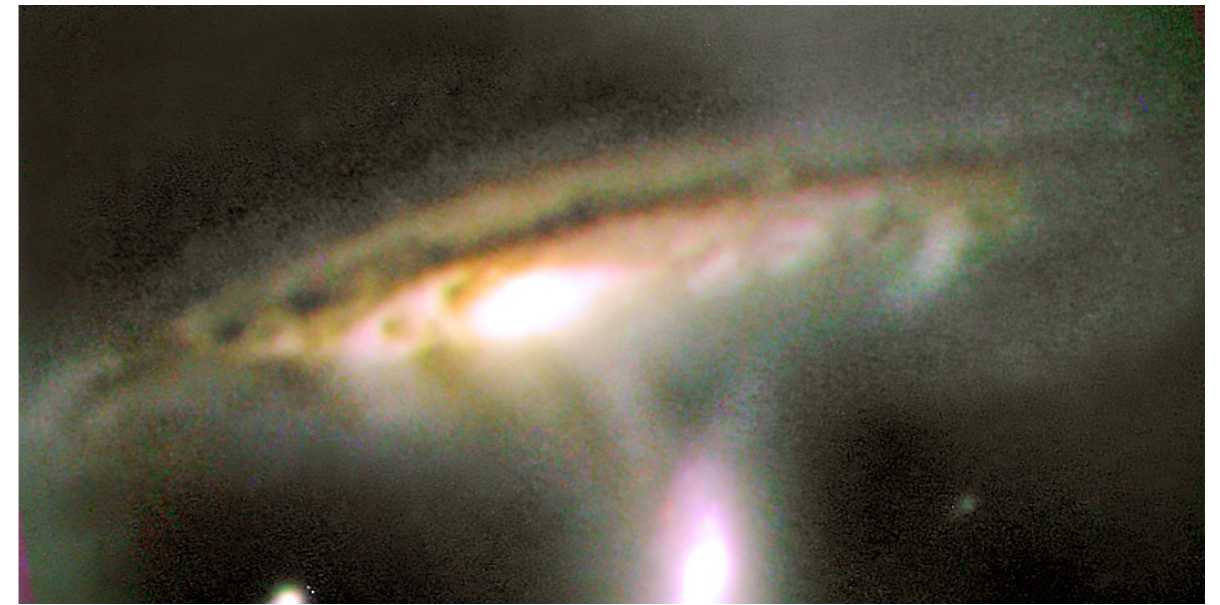
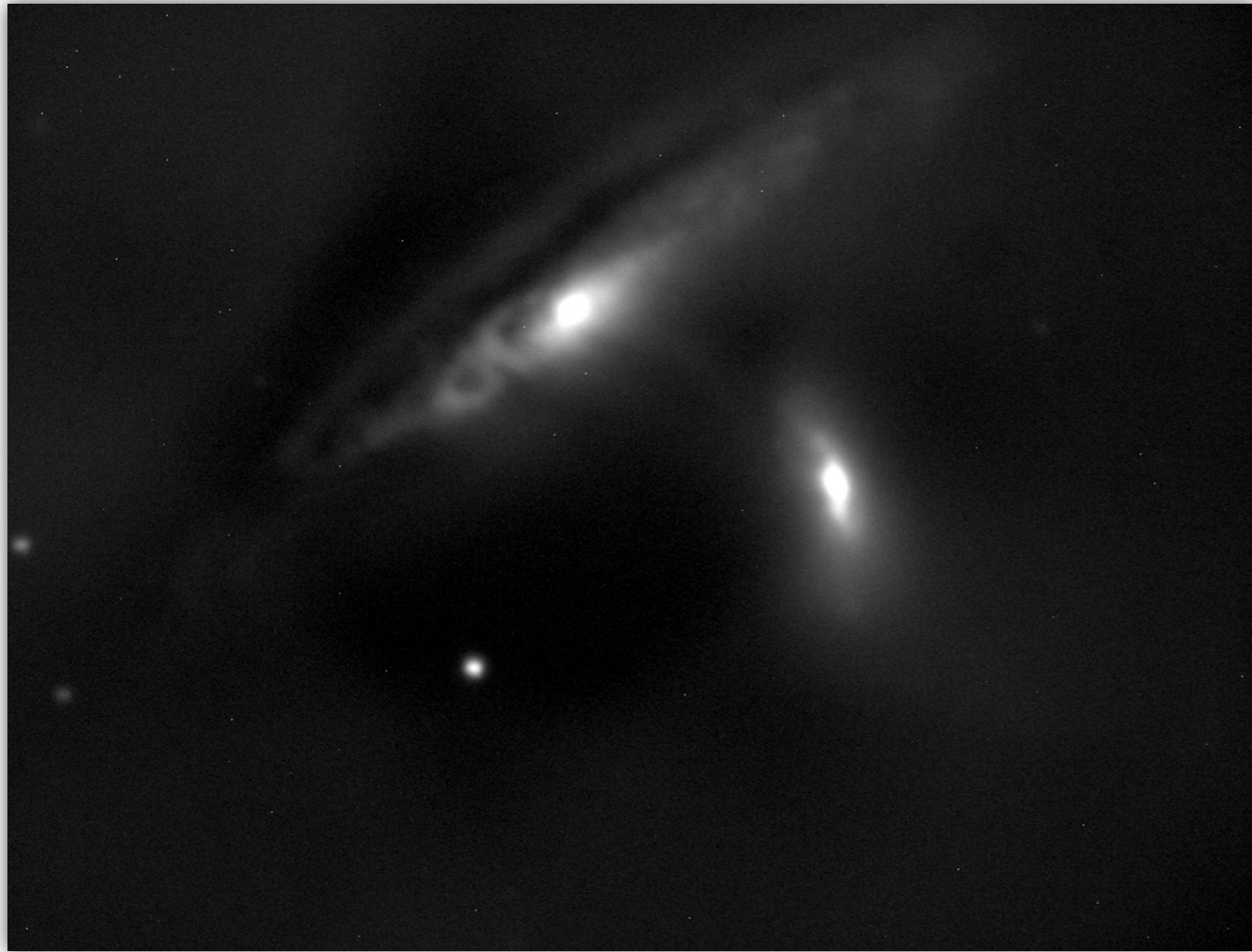


Image Quality: 0.8 arcsec

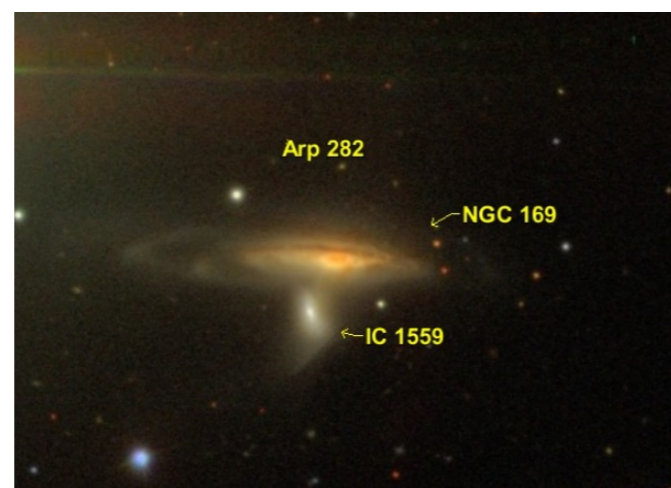
NGC23 (mag 12, 173 Mly)



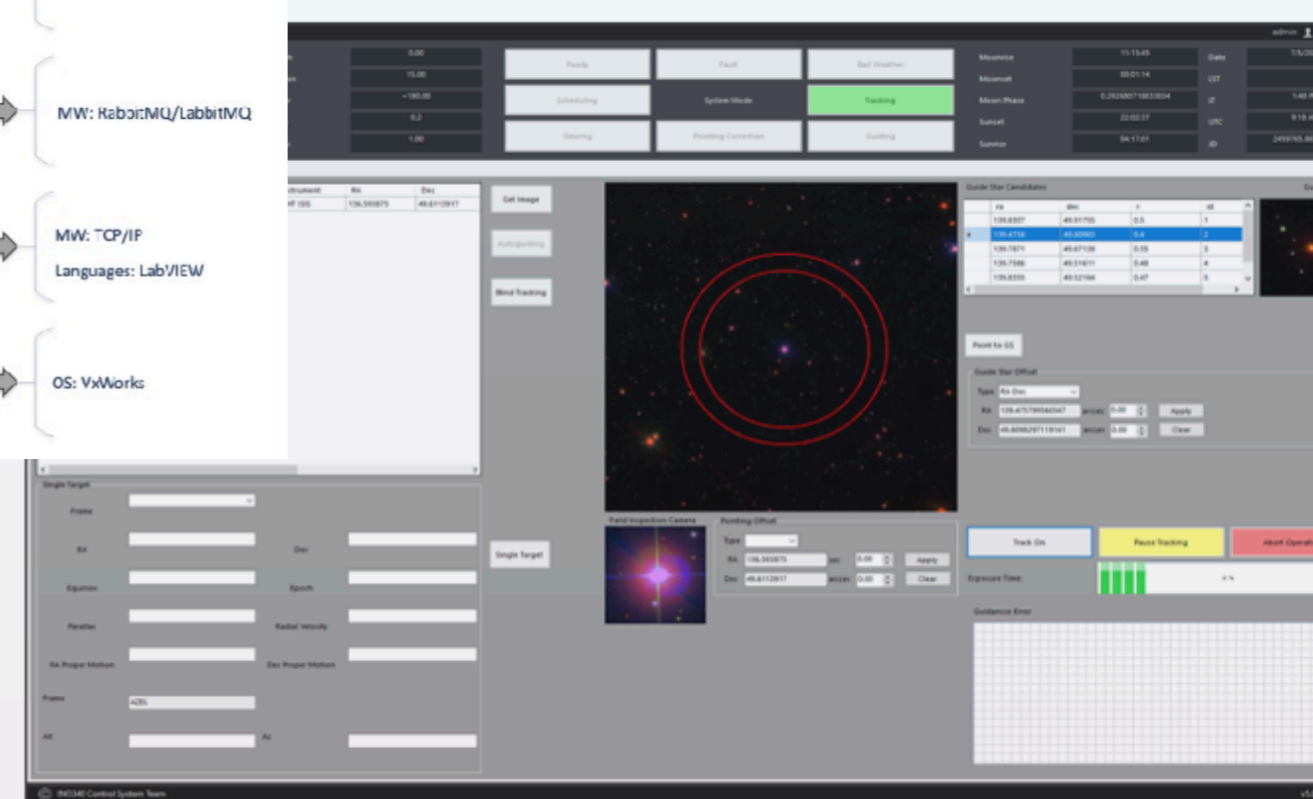
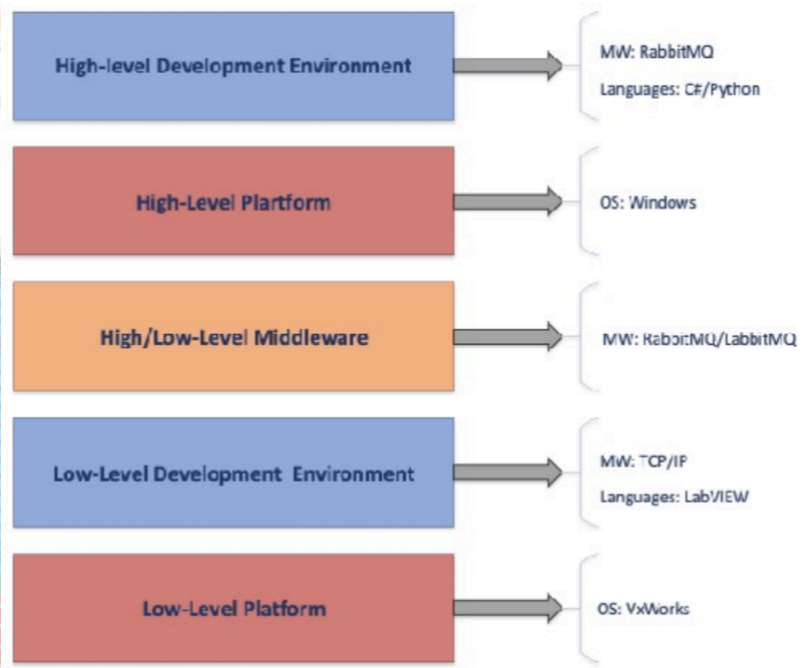
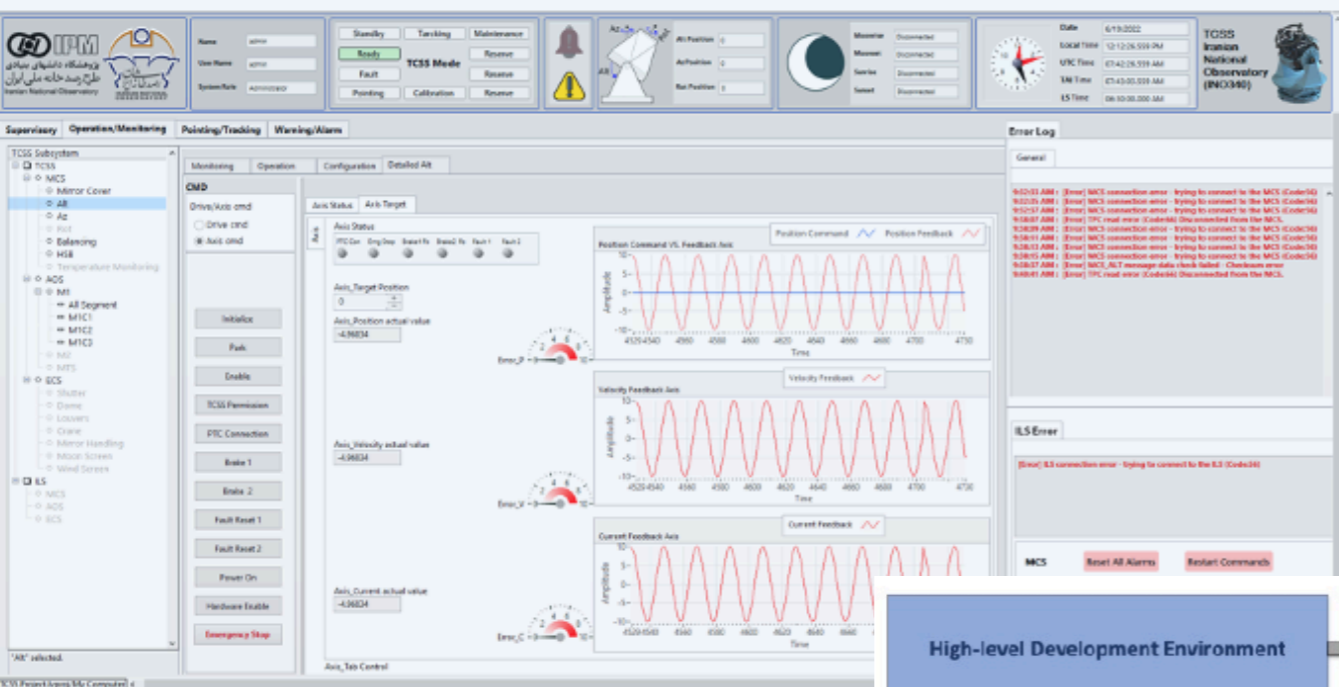
Image Quality: 0.65 arcsec



Arp 282, 320 Mly



The control system and software development



User Interface

Observation Application

The Observation Application interface includes a top navigation bar with user information (Name: Admin, System Role: Administrator) and system status (Ready, Tracking). The main area is divided into several sections:

- Observation Configuration:** A table listing observation entries with columns for Epoch, Item, Target, Instrument, RA, and Dec.
- Star Selection:** A large image of a star field with a red circle highlighting a target. A 'Quick Star Candidates' table lists potential stars with RA, Dec, and magnitude.
- Tracking Status:** A progress bar showing 'Tracking Time' at 26%, with buttons for 'Pause Tracking' and 'Abort Operation'.
- Sequence Commands:** A log of system events such as 'Offline scheduling done successfully' and 'Image fetched from OCS server'.

Site Monitoring Application

The Site Monitoring Application provides a comprehensive overview of site conditions. It features a top status bar with current values for Temperature (4.8°C), Humidity (99.4%), Wind Speed (4.513 m/s), and Seeing. The main display consists of four panels:

- Temperature:** A line graph showing temperature fluctuations over time.
- Humidity:** A line graph showing humidity levels over time.
- Wind Speed:** A line graph showing wind speed variations over time.
- Seeing:** A line graph showing seeing conditions over time.

Additional features include a 'System Status' sidebar with links for Sun, Moon, and Moon Phase, and a 'Date' section showing the current date and time in multiple formats.

Telescope Operation Application

The Telescope Operation Application is designed for manual control of the telescope's mechanical systems. It includes several control panels:

- User Info:** Fields for Username, System Role, and Proposal Number.
- INOCS Setup:** A grid of controls for various subsystems (TCSS, Alt/Az, Mirror Cover, Balancing, HSB, Primary Mirror, Secondary Mirror, Adapter, Inteflock), each with an 'ON' indicator and status (0% Ready).
- Enclosure Control System:** Controls for the Enclosure System (0% Ready) and Shutter (0% Open), with buttons for 'Apply' and 'Close All'.
- Temperature Monitoring:** A central panel showing 'Outside Temp: 00.00', 'Inside Top Temp: 00.00', and 'Inside Bottom Temp: 00.00'.
- Alarm Indicators:** Buttons for Sun Alarm, Dew Point Alarm, Too Hot Warning, Wind Alarm, Rain Alarm, and Too Cold Warning.
- Air Conditioning:** Controls for 'Off', 'Automatic', and 'Manual' modes, along with a 'Temp Setpoint (°C)' set to 15.
- Moon Data:** Fields for Moon Rise, Moon Set, Moon Phase (%), and Angular Separation (').

Alarm/Warning Application

The Alarm/Warning Application provides a clear visual status of the telescope's health. It features a 'Monitoring Control' section with eight status indicators:

- Alt:** Green square (Ready)
- Az:** Green square (Ready)
- HSB:** Yellow square with a warning icon (Warning)
- Top unit:** Red square with a warning icon (Warning)
- M1 Cell:** Green square (Ready)
- Mirror Cover:** Green square (Ready)
- Shutter:** Green square (Ready)
- Instrument:** Green square (Ready)

Below the monitoring controls is an 'Alarm Log' table:

Alarm ID	DateTime	Description	Subsystem	Severity
1547	23:18 [09-19-2017]	High temperature	Top unit	High
1784	00:05 [09-19-2017]	Low oil pressure	HSB	Low

To the right of the monitoring controls is a 'Logs' section with a detailed table of system events:

Log ID	DateTime	Description	Subsystem
5214	23:18 [09-19-2017]	Guid star is in range.	Observing Engine
1685	23:20 [09-19-2017]	Pointing started.	Observing Engine
5687	23:21 [09-19-2017]	Alt repositioning	Alt sys.
4475	23:21 [09-19-2017]	Azimuth repositioning	Az sys.
4457	23:22 [09-19-2017]	Tracking started.	Observing Engine
9674	23:22 [09-19-2017]	Autoguider is on.	Observing Engine
1275	23:22 [09-19-2017]	10 sec exposure.	Observing Engine
2500	23:23 [09-19-2017]	Seeing updated.	BMS
3675	23:23 [09-19-2017]	M1 checked.	Alarm Manager
3698	23:24 [09-19-2017]	Top Unit check.	Alarm Manager
5273	23:24 [09-19-2017]	Top unit error detected.	Top Unit sys.
5230	23:28 [09-19-2017]	Oil pressure checked	Alarm Manager
1744	23:27 [09-19-2017]	Oil pressure warning	HSB

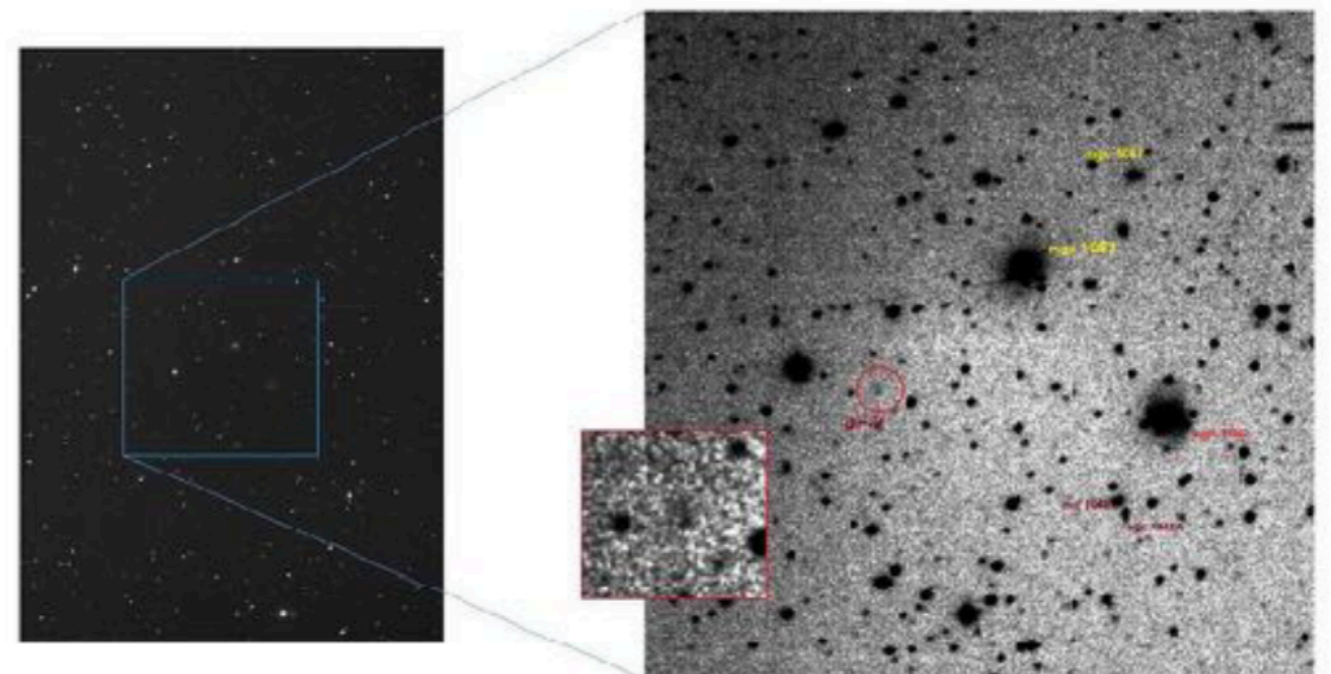
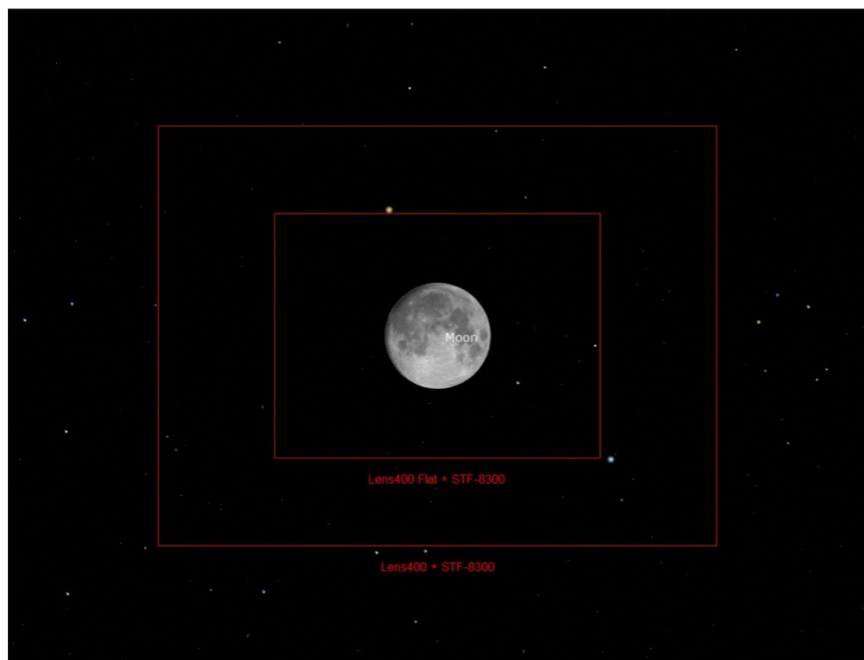
INO Lens Array facility

Main Parameters

Focal Length	400 mm
Lens Diameter	140 mm
Focal Ratio	2.8
Lens Construction	16 Elements in 12 Groups
Field of View	154 x 116 arcmin wide field array
CCDs	SBIG STF-8300 Monochrome
Pixel Scale	2.785 arcsec/pix
Filters	B, V, R Photometric Filters
Filter Size	52 mm Drop-In



Since the time sensitivity of transient events requires prompt response by observers, these targets will have the highest priority in INOLA observations.



The field of view of the INOLA compared to the size of the full Moon

Science with 4m telescopes

Galactic

Exoplanets

Microlensing

Stars

Magnetism in WDs
Pre-MS stars
ISM
Metallicity

Solar system

Planetary studies to
surveys



Extra-galactic

Galaxy

Dwarfs to giants
morphology, star
formation, metallicity,
Kinematics,
Environment, Dark
matter, LSBs
Gravitational lensing

AGNs & Quasars

Environments and
hosts
AGN variability

INO operation modes

Regular observing time

Astronomers can apply to this in one of the following modes by submission of Phase I (and Phase II) proposals.

Visiting

The visiting mode will allow training of new observers.

Service

Mostly dedicated to programs requiring short exposures over many nights

Large/Survey programs

These will be set up by the INO in collaboration with the community of astronomers with international presence.

The surveys will be conducted by students assigned to these programs.

Guaranteed time

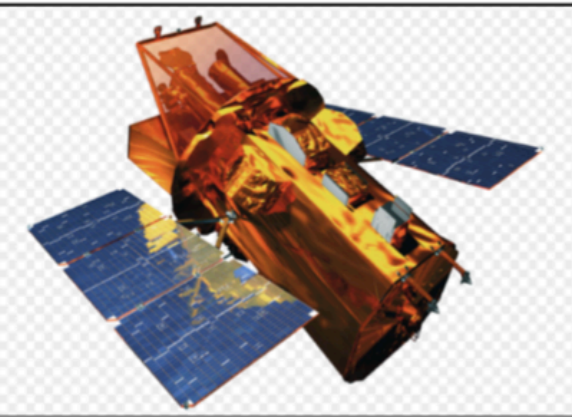
Target of opportunity

INO is likely to adopt a conditional “open sky” policy. A condition that engages the local community.

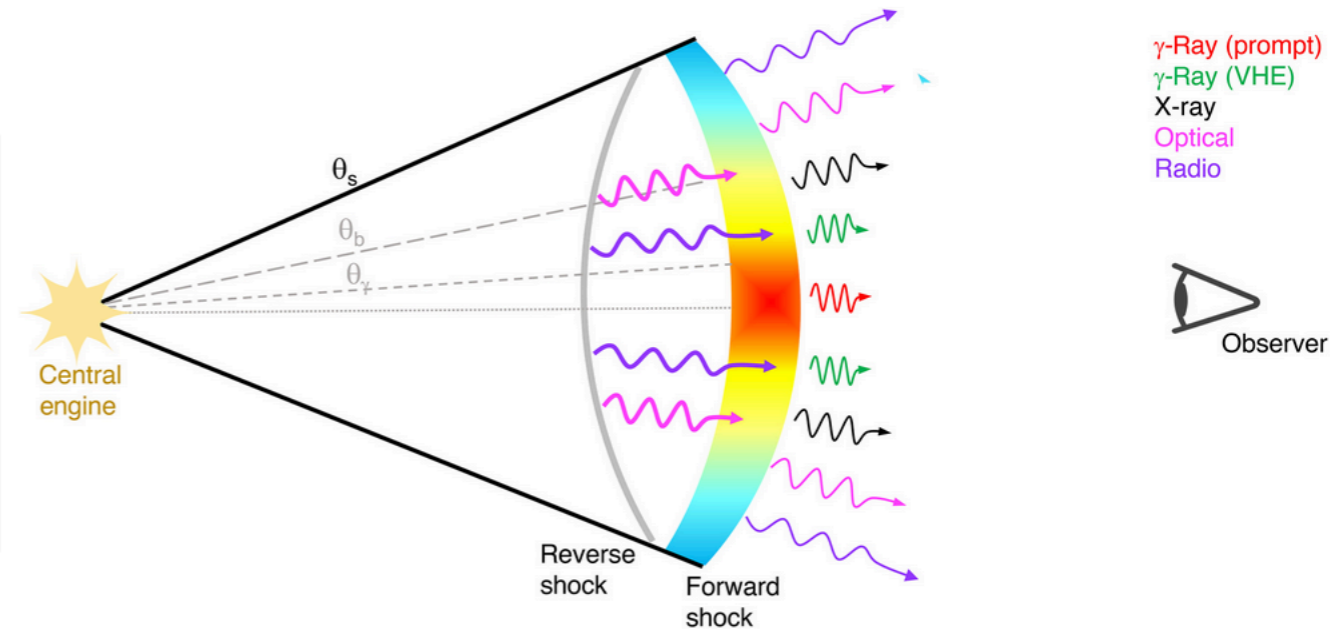
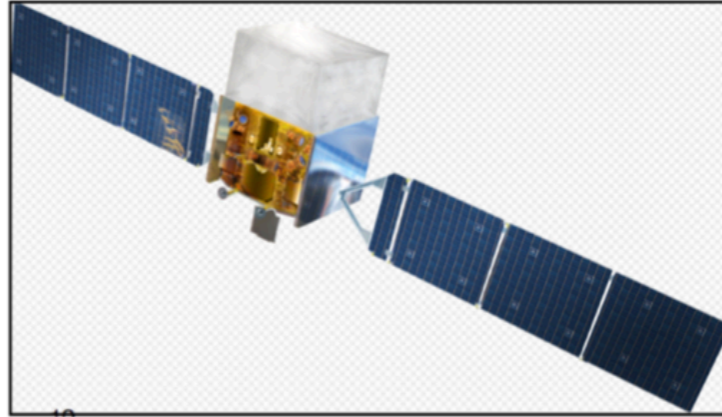
GRB Event Rate

current generation of GRB detectors (e.g. BATSE, *Swift*/BAT, *Fermi*/GBM) have a sensitivity limit of the order of 10^{-8} erg cm $^{-2}$ s $^{-1}$. With such a threshold, an ideal imaginary 4π all-sky detector on average would detect ~ 600 – 1000 GRBs/yr, or ~ 2 – 3 GRBs/day. For example, *Swift*/BAT has a field of view of $\sim 1/7$ all sky, and detects 2–3 GRBs per week.

SWIFT 2004-PRESENT



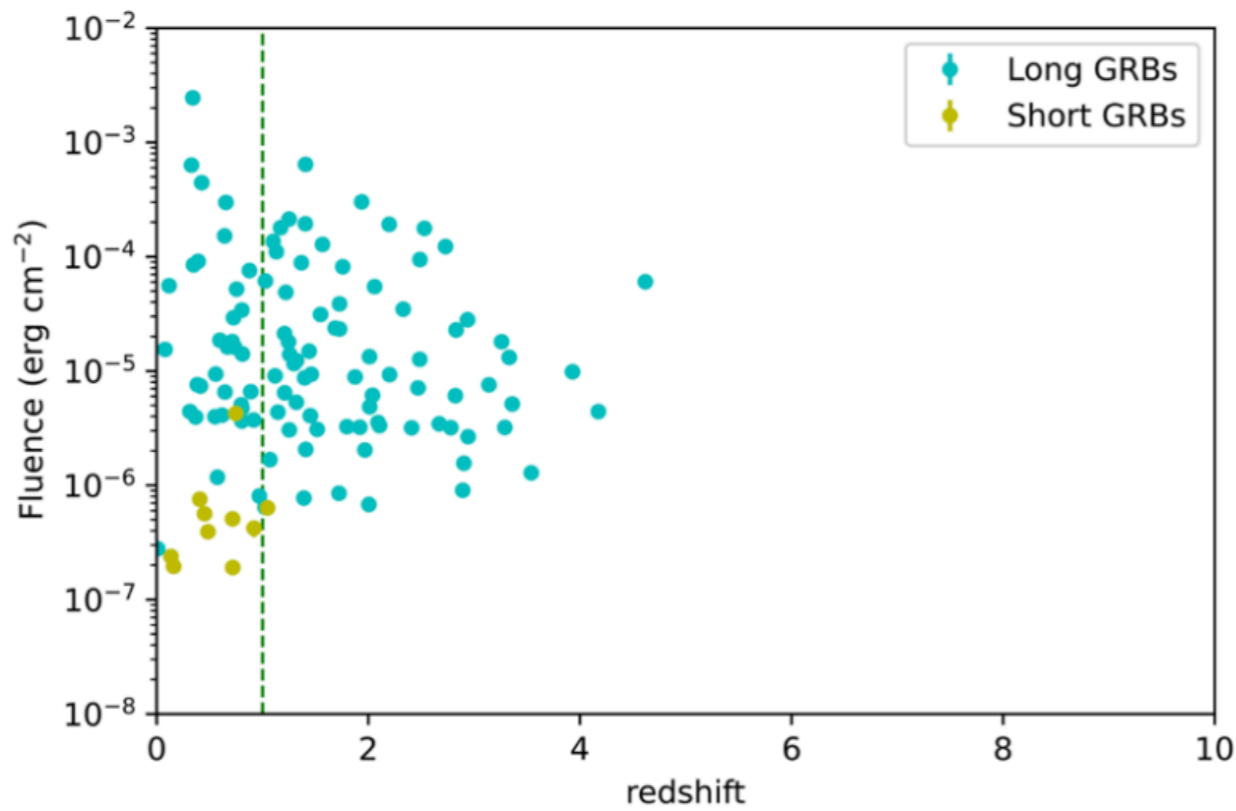
FERMI 2008-PRESENT



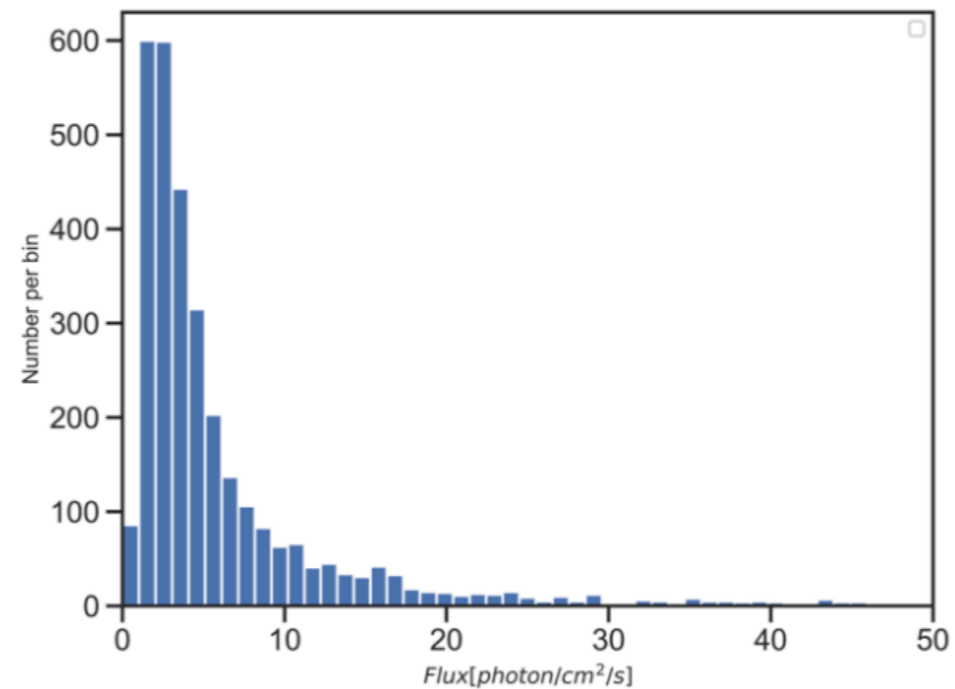
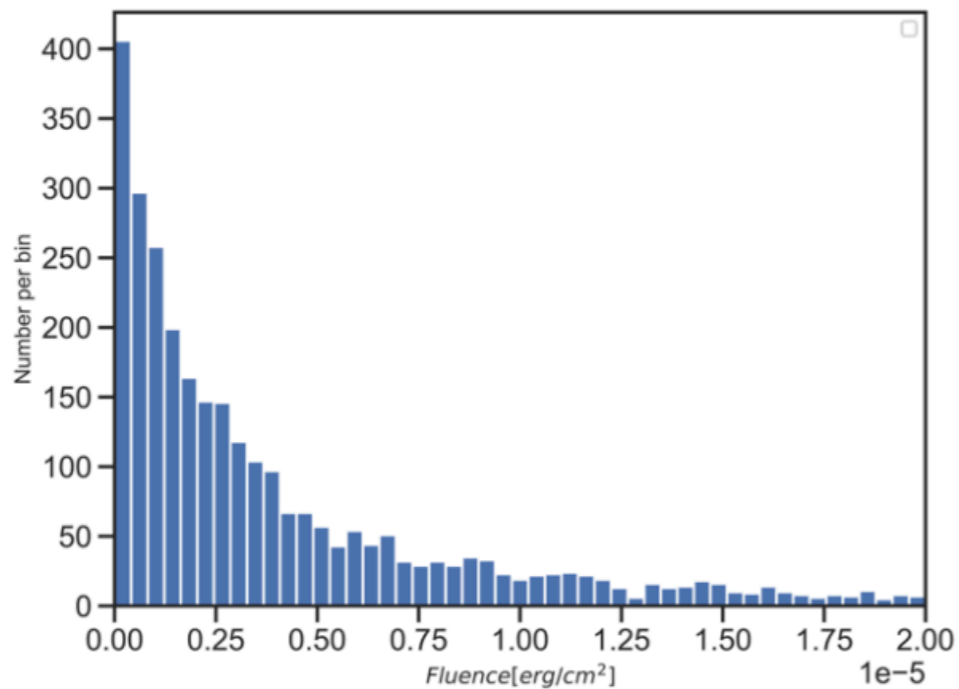
$$\dot{\rho}_{0,\text{tot},50}^{\text{HL}} \sim 500 \dot{\rho}_{0,50}^{\text{HL}} \sim (250 - 500) \text{ Gpc}^{-3} \cdot \text{yr}^{-1} \sim (12.5 - 25) \text{ gal}^{-1} \cdot \text{Myr}^{-1}$$

$$\dot{\rho}_{0,\text{tot},50}^{\text{SGRB}} \sim (13 - 75) \text{ Gpc}^{-3} \cdot \text{yr}^{-1} \sim (0.6 - 4) \text{ gal}^{-1} \cdot \text{Myr}^{-1}$$

Defining essential criteria for follow-up observations

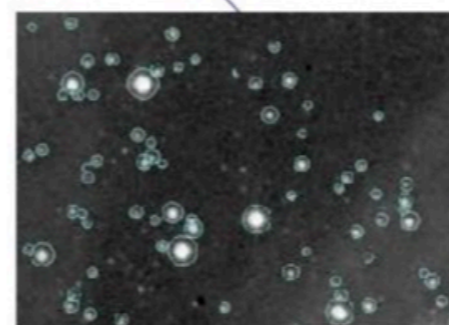
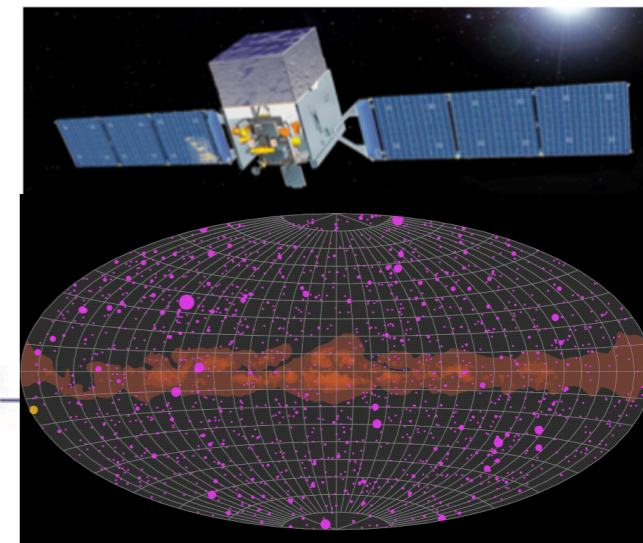
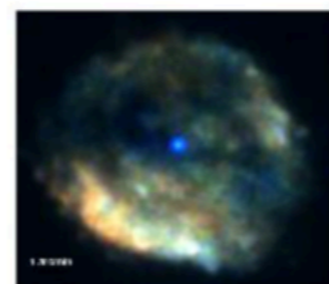
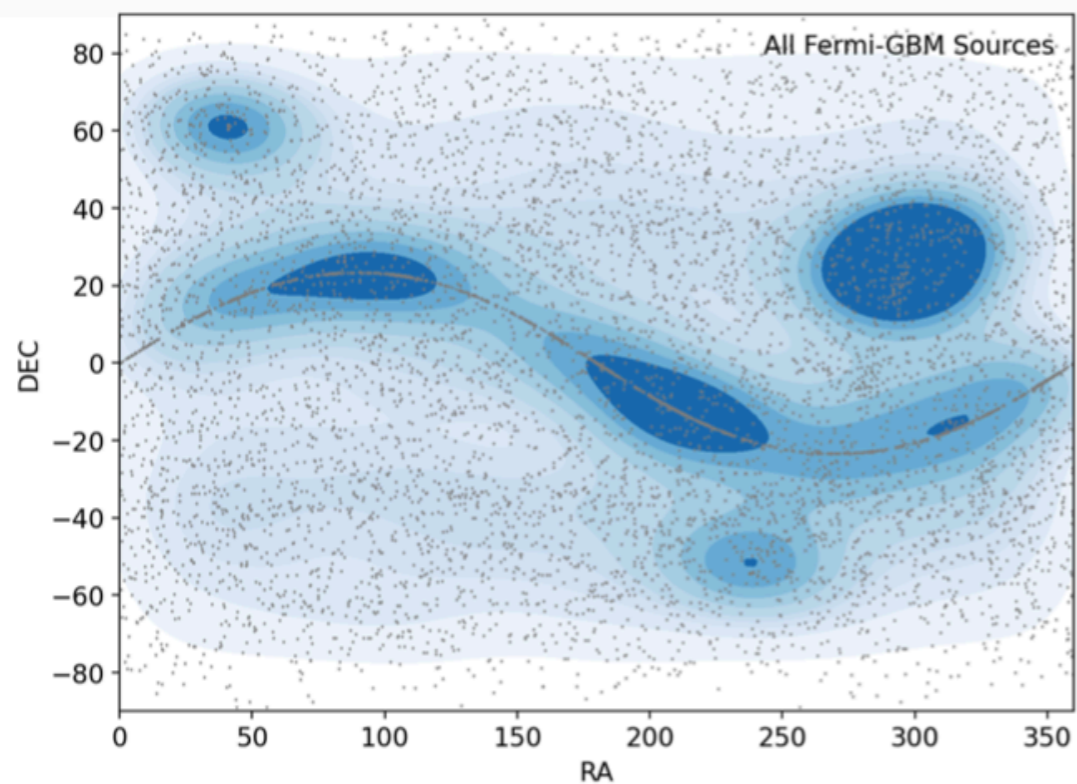
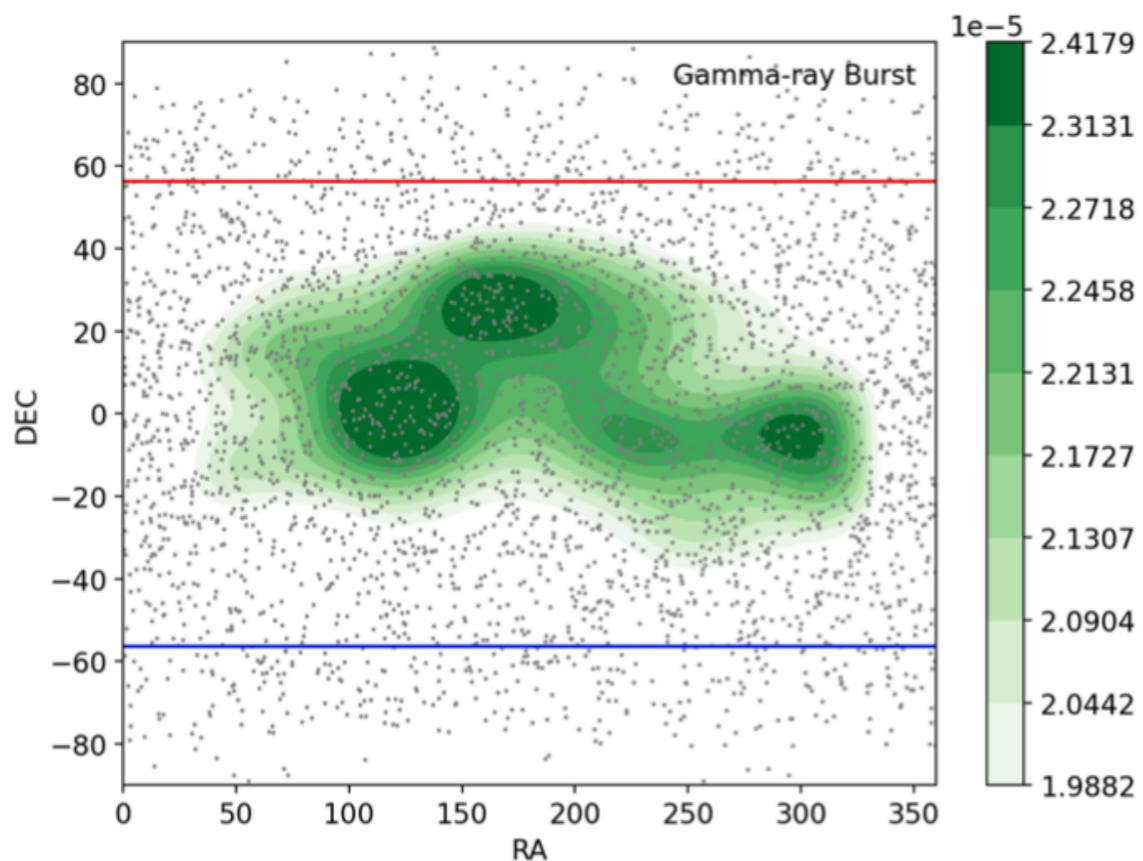


Redshift vs Fluence distribution of 157 GRBs observed by Fermi.



Fluence distribution (left) and Flux distribution (right) of 3225 GRBs observed by Fermi GBM.

Visibility of GRBs for Ground Based Telescopes

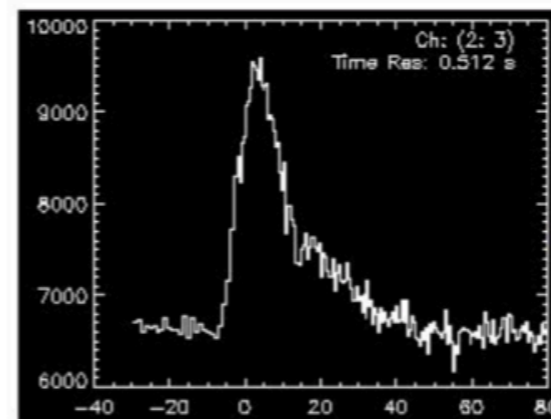


Fermi/Swift send a message at
Observatory



Telescope point

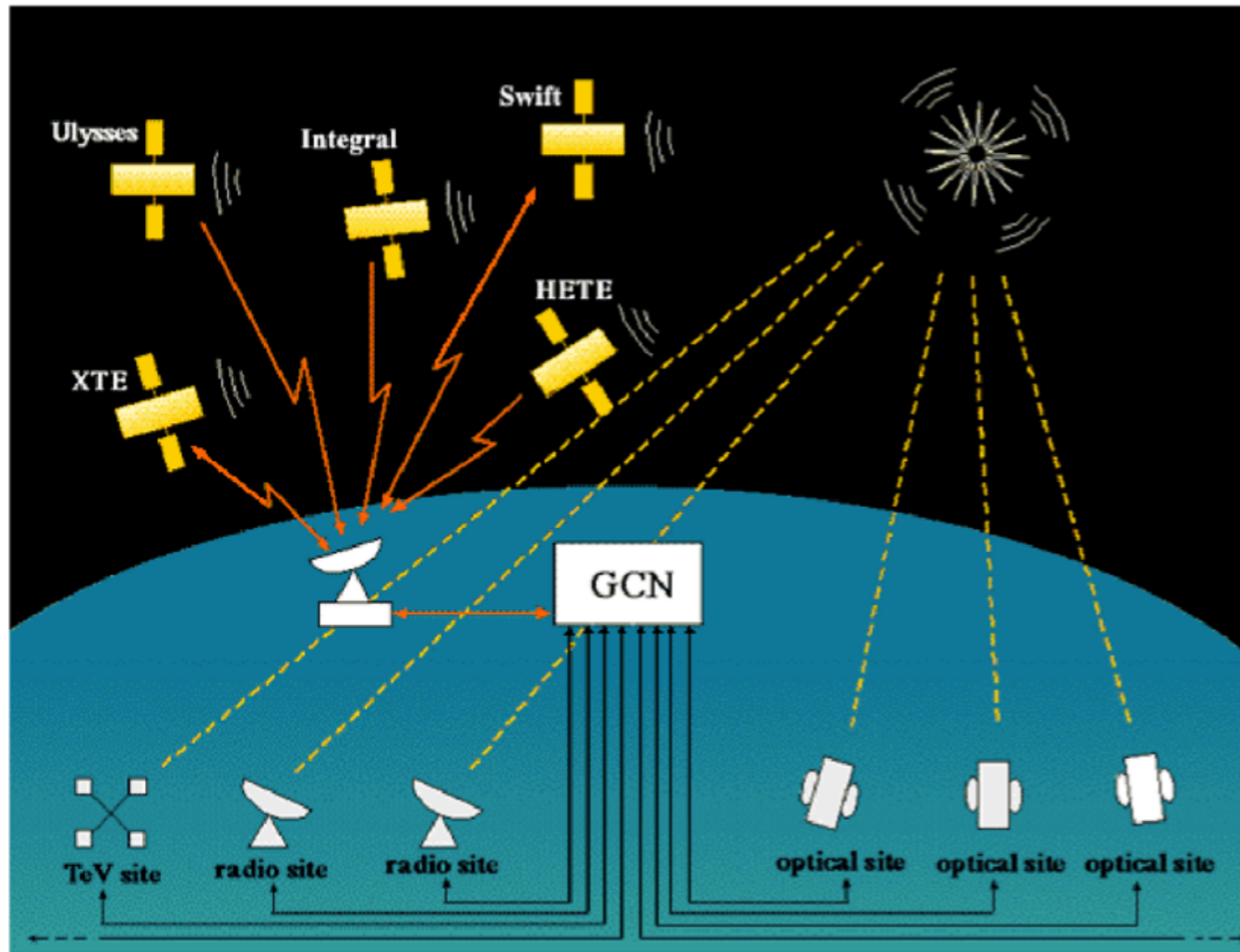
Followup and lightcurve



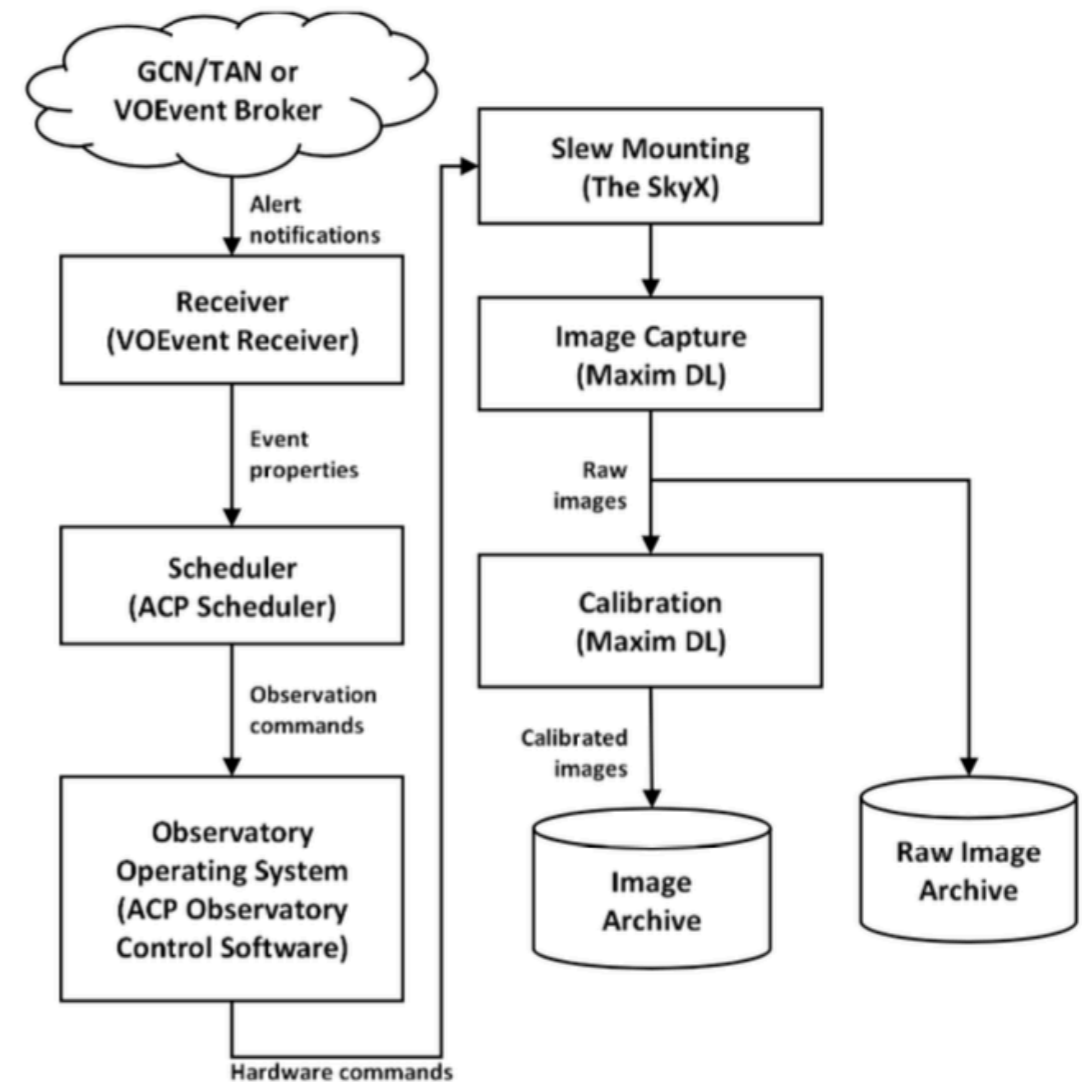
Coordinates $33^{\circ}40'27''\text{N}$
 $51^{\circ}19'07''\text{E}$

Observatory should continuously monitor GRB alert notifications that NASA sends over the network. When an alert is detected, the computer observatory assess whether the object is sufficiently above the horizon in order to be observed. If the test is successful, the computer stops the ongoing observations, automatically points the GRB and began to photograph it for the rest of the night.

Follow - Up GRB Observations



The Gamma-ray bursts Coordinates Network (GCN)



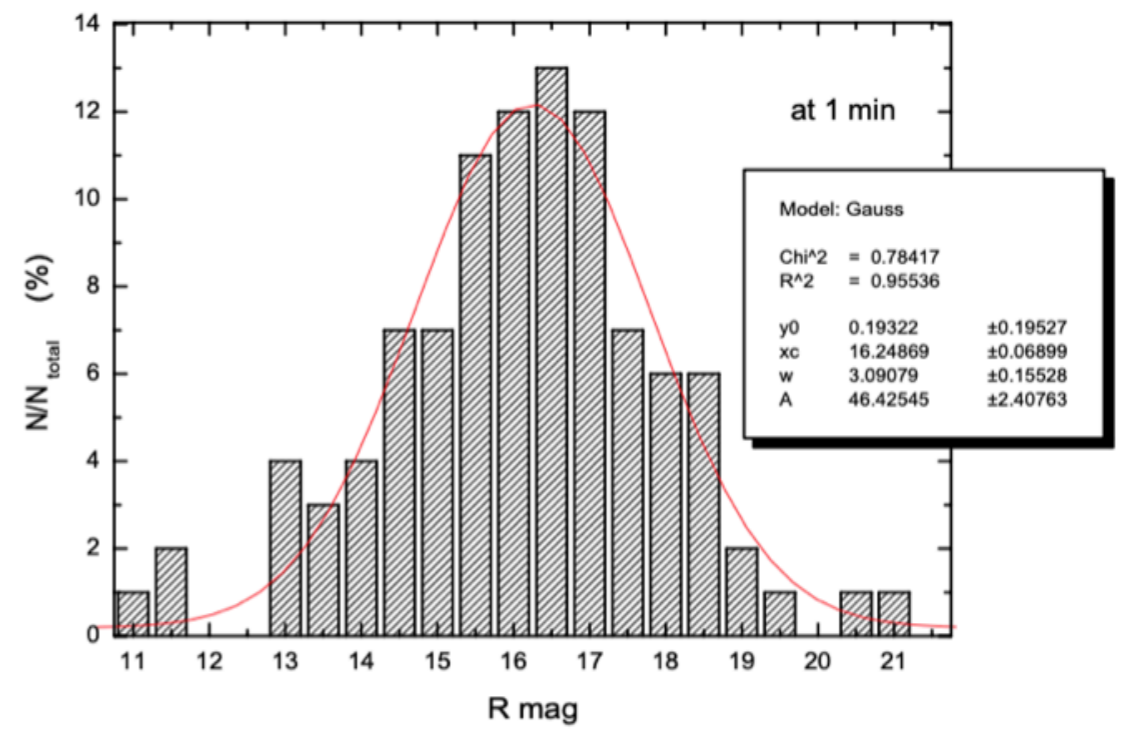
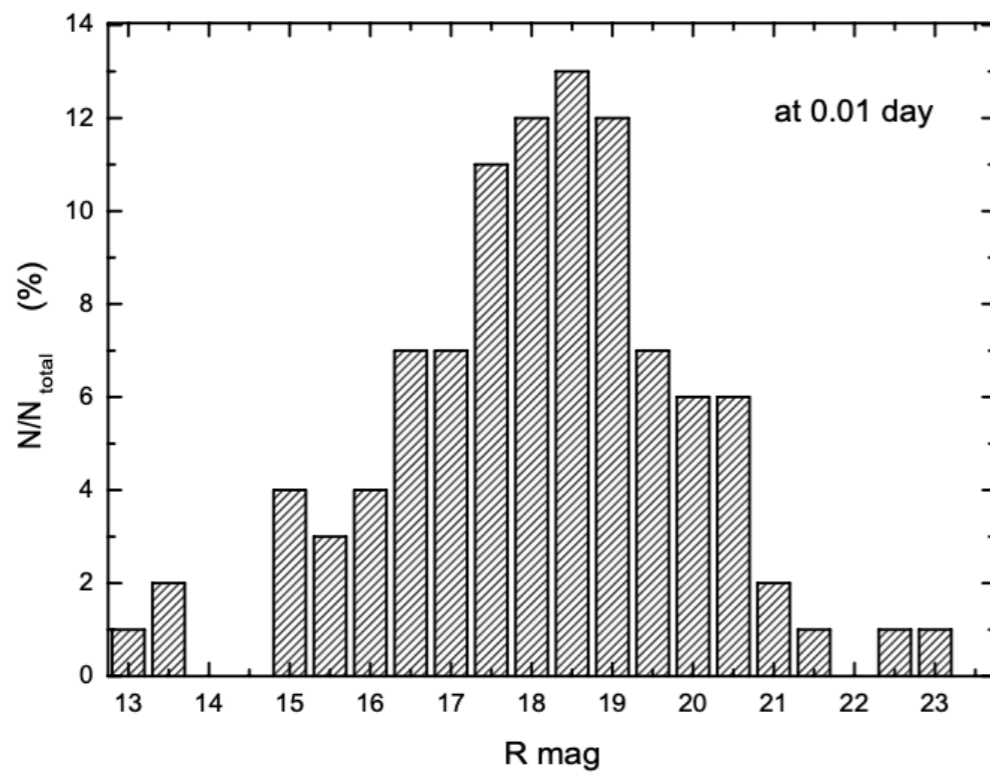
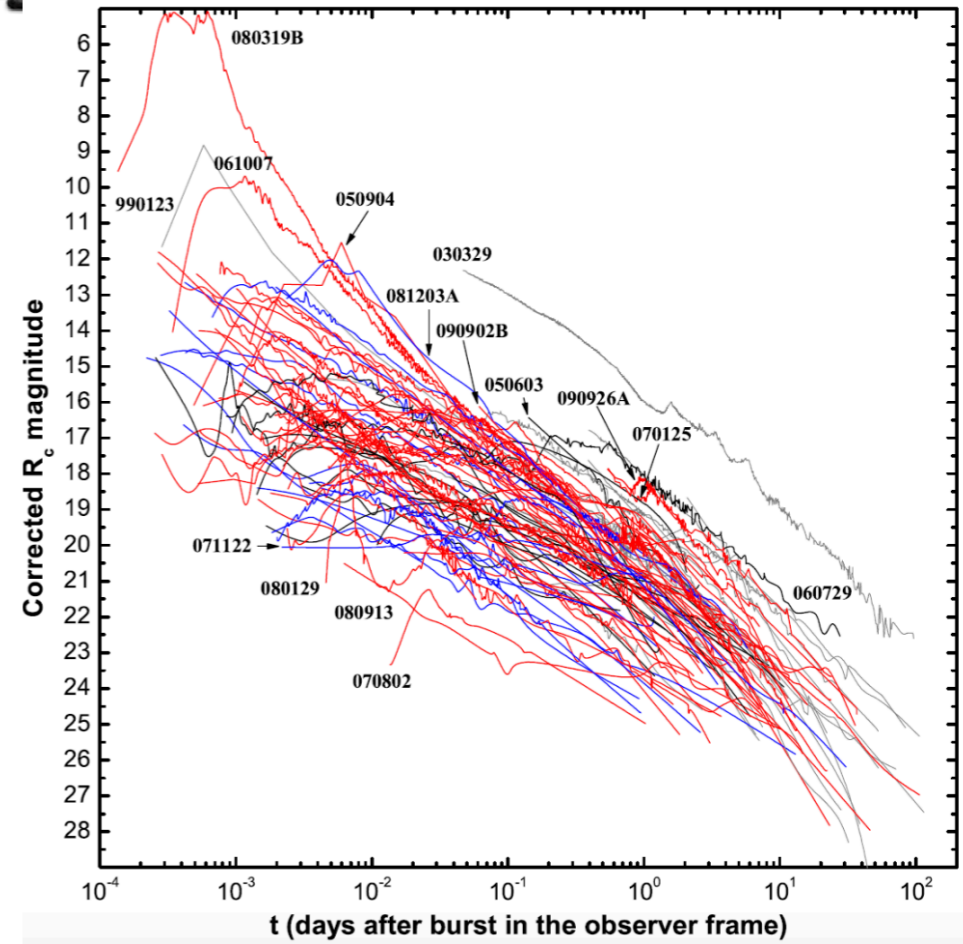
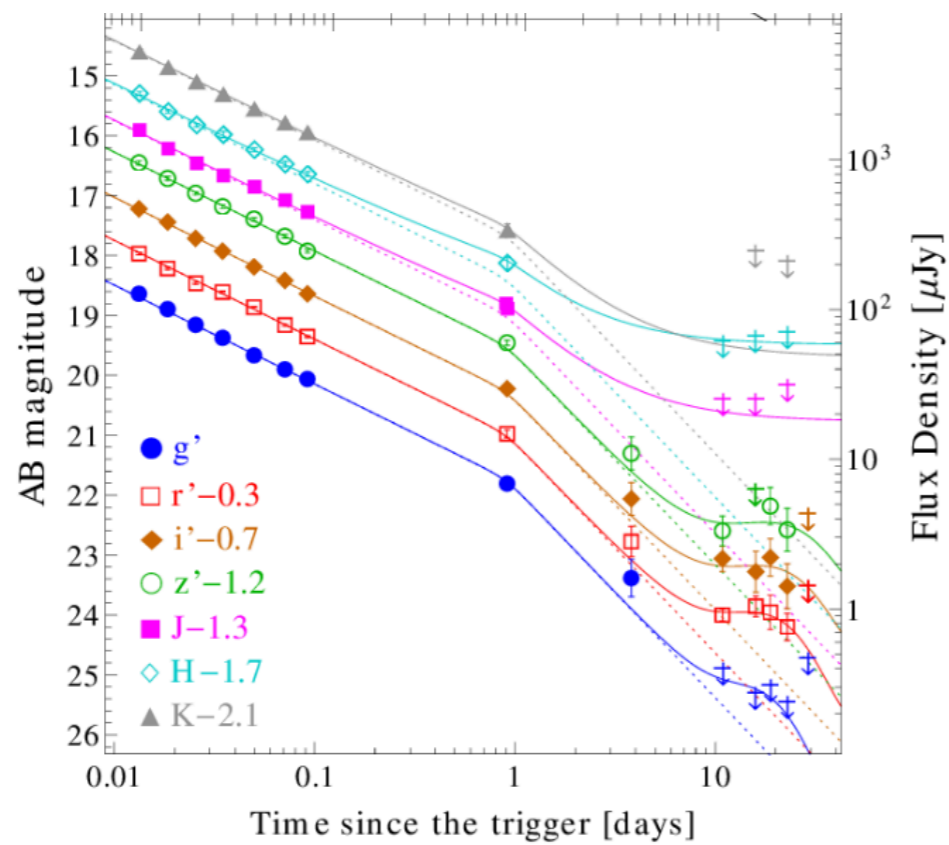
Automatic GRB follow-up Observation

Whenever a satellite reveals a GRB phenomenon, NASA collects and analyzes information quickly and automatically notifies all observers of the network events worthy of being observed.

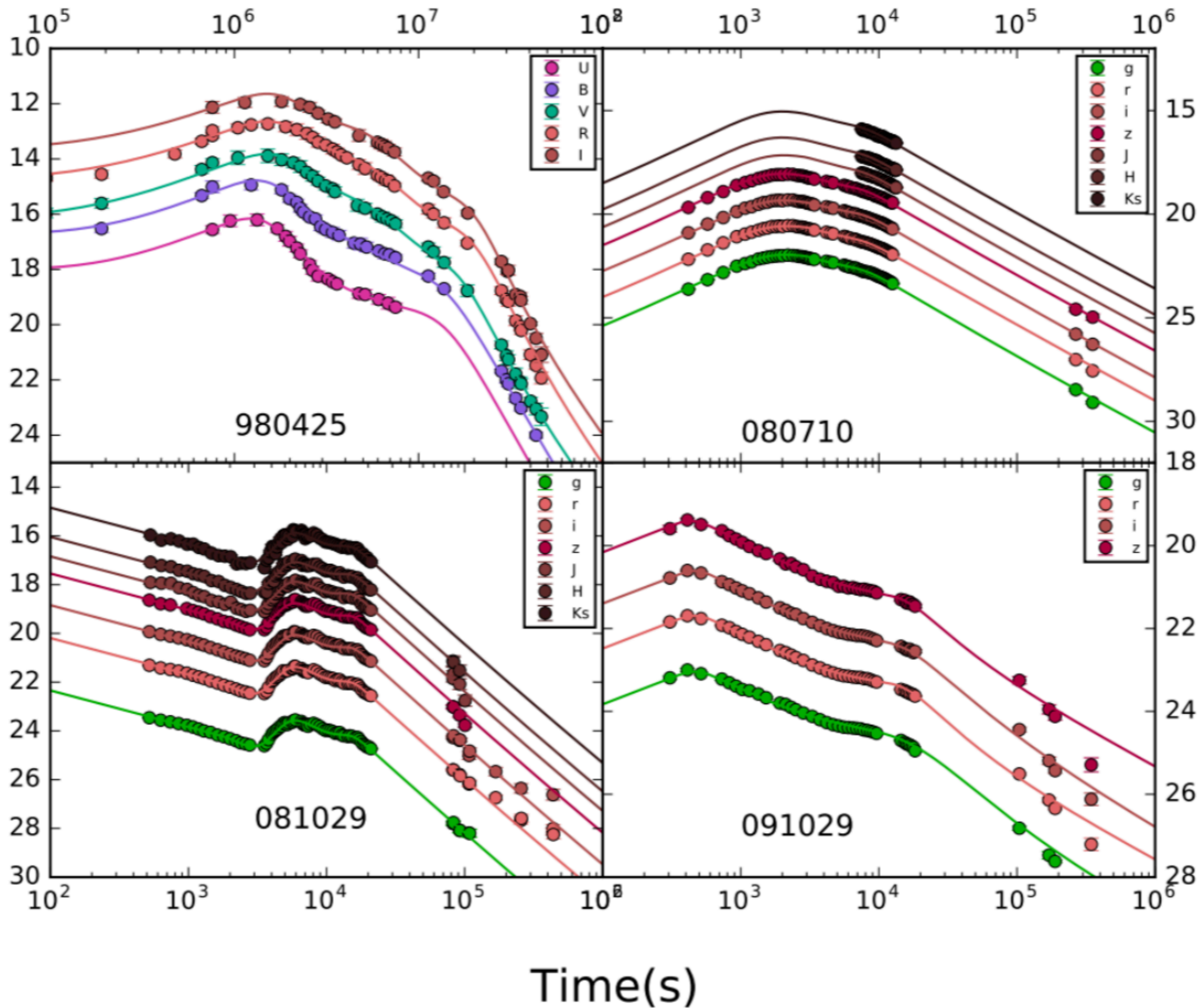
The astronomical observatories which are in condition visibility and operation can be performed follow-up observations

$$m(t_2) = m(t_1) + 2.5\alpha \log \left(\frac{t_2}{t_1} \right)$$

Afterglow Flux $F \propto t^{-\alpha}$ ($0.4 \lesssim \alpha \lesssim 1/4$)



Magnitude

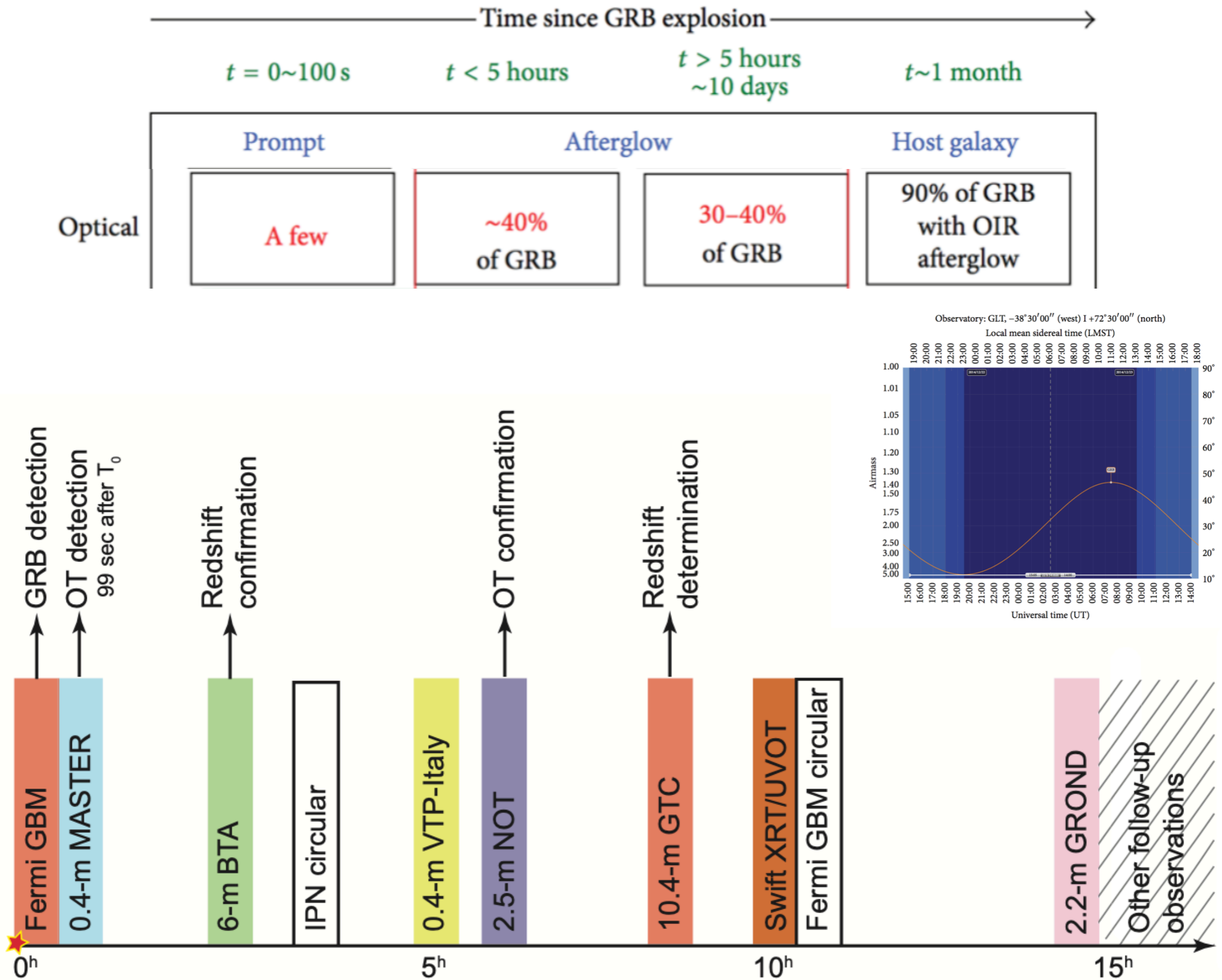


Small Telescopes: AbAO (0.2m), Kitab (0.2m), TAROT (0.25m), Challis Observatory (0.4m), Santel-400AN (0.4m), Hankasalmi Observatory (0.4m), ISON-NM (0.4m), Searchlight Observatory Network (0.4m), iTelescope T21 (0.43m), ISON-NM (0.45m), Monte Agliale Observatory (0.5m), MITSuME (0.5m), VT-50 (0.5m), GRAS 011 (0.51m), SNUO (0.6m), SOAO (0.6m), BOOTES-2 (0.6m), Burke-Gaffney (0.6m), REM (0.6m), Konkoly (0.6m), Mt John University Observatory (0.61m), Lightbuckets (0.61m), Ondrejov (0.65m), Terskol (0.65m), Abastumani Observatory AS-32 (0.7m), GIT (0.7m), HCT (0.7m), KAIT (0.76m), TNT (0.8m), Mondy (0.8m), IAC80 (0.82m), SARA-KP (0.9m).

Medium Telescopes: Nickel (1m), Siding Springs (1m), Lulin (1m), T100 (1.0m), GT-McDonald (1m), Weihai (1m), TUBITAK T100 (1m), Zadko (1m), MLO (1m), DOAO (1m), BAO (1m), Murikabushi (1m), GT (1m), SARA-RM (1.0m), TSHAO (1m), Zeiss-1000 (1m), ARIES Nainital (1.04m), Kiso Observatory (1.05m), Calar Alto (1.23m), CTIO (1.3m), PAIRITEL (1.3m), Devasthal (1.3m), TLS (1.34m), IRSF (1.4m), Kanata Telescope (1.5m), OSN (1.5m), RATIR (1.5m), Maidanak (1.5m), HJT (1.5m), Sierra Nevada (1.5m), Sayan (1.6m), Pan-STARRS 1 (1.8), Asiago Telescope (1.82m), LCO (2m), Nayuta (2m), Liverpool (2m), Tautenburg (2m), Faulks South (2m), HCT (2m), McDonald Observatory (2.1m), Xinglong (2.16m), CAHA (2.2m), MPG (2.2m), GROND (2.2m), Bok (2.3m), GMG (2.4m), NOT (2.5m), FRAM (2.5m), Newton-Sintesz (2.54m), MPG (2.2m), OAJ (2.6m), Lick Shane (3m), WIYN (3.5m), TNG (3.58m), DOT (3.6m), William Herschel (4.2m), Lowell (4.3m), DCT (4.3m).

Large Telescopes: SAO RAS (6m), BTA (6.05m), MMT (6.5m), Magellan (6.5m), Gemini-South (8m), VLT(8.2m), LBT (8.4m), GTC (10.4m).

GRB	redshift	FLUENCE	[Small Telescopes], [Medium Telescopes], [Large Telescopes]
210722A	1.145	4.37E-06	[TAROT, GIT], [RATIR], []
210619B	1.937	3.02E-04	[Konkoly, AbAO, GIT, KAIT], [Deep CAHA, NOT, Xinglong, Liverpool, TNG], [GTC, SAO RAS]
210610B	1.13	1.10E-04	[AbAO, REM, KAIT, MITSuME], [Newton-Sintesz, Liverpool], []
210610A	3.54	1.28E-06	[AbAO, KAIT, MASTER, MITSuME], [Maidanak, CAHA, RATIR, OSN], [SAO RAS]
210204A	0.876	7.57E-05	[Assy and Mondy], [DOT], []
201221D	1.046	6.36E-07	[], [DOT, LCO, Lowell, FRAM, NOT], []
201216C	1.1	1.36E-04	[Terskol, Mondy], [Liverpool, FRAM], [VLT]
201021C	1.07	1.68E-06	[TAROT, MASTER], [], [VLT]
201020B	0.804	3.41E-05	[Mondy, HCT and GIT, Konkoly, MASTER], [Maidanak, DFOT,], [GTC]
201020A	2.903	1.56E-06	[GIT, MASTER, MITSuME], [DFOT], [GTC]
200829A	1.25	2.14E-04	[Konkoly], [Liverpool], [SAO RAS]
200826A	0.7481	4.26E-06	[], [TNG, Lowell], [LBT]
200613A	1.22	4.89E-05	[Mondy, AbAO, MITSuME], [Liverpool], [SAO RAS]
200524A	1.256	1.40E-05	[MITSuME, KAIT], [OAJ, CAHA, DFOT], [SAO RAS]
191011A	1.722	8.52E-07	[MASTER], [RATIR, GROND], [VLT]
190829A	0.0785	1.54E-05	[MASTER], [Liverpool, LCO, TNG], [GTC, MMT]
190719C	2.469	7.12E-06	[], [NOT], [VLT]
190613A	2.78	3.20E-06	[Kitab and AbAO, KAIT, MASTER], [FRAM, SEDM], []
190114C	0.425	4.43E-04	[], [], [GTC]



ICRANet - Isfahan Astronomy Meeting

UNDER THE AEGIS OF
H.E. MOHAMMAD ALI ZOLFIGOL, MINISTER OF SCIENCE, RESEARCH AND TECHNOLOGY (MSRT), ISLAMIC REPUBLIC OF IRAN

ICRANET-ISFAHAN ASTRONOMY MEETING

3-5 NOVEMBRE 2021 **VIRTUAL MEETING**

FROM THE ANCIENT PERSIAN ASTRONOMY TO RECENT DEVELOPMENTS IN THEORETICAL AND EXPERIMENTAL PHYSICS, ASTROPHYSICS AND GENERAL RELATIVITY

WITH A WORKSHOP ON DATA SCIENCE IN RELATIVISTIC ASTROPHYSICS

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ASTRONOMICAL and ASTROPHYSICAL TRANSACTIONS

Journal of the *Eurasian Astronomical Society*

ISSN: 1055-6796

Remo Ruffini, Yousef Sobouti, Soroush Shakeri
Guest Editors

CSP Cambridge Scientific Publishers

<https://www.aaptr.com/>

Transient Events and Multi-Messenger Astrophysics

TRANSIENT EVENTS AND MULTI-MESSENGER ASTROPHYSICS

28 - 29 July 2022 6 - 7 Mordad 1401

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Designed by: ADB

A large, bright, golden-yellow full moon dominates the upper half of the frame, set against a dark, clear sky. In the foreground, a dark, silhouetted hill features a telescope structure on the right side, consisting of a cylindrical base and a multi-tiered upper section. The moon's surface shows various craters and darker patches. The overall scene is captured during twilight or night.

Thanks for Your Attention
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