

AEON+

Overview



W. M. KECK
OBSERVATORY



SKYNET ROBOTIC
TELESCOPE NETWORK



National Radio
Astronomy
Observatory

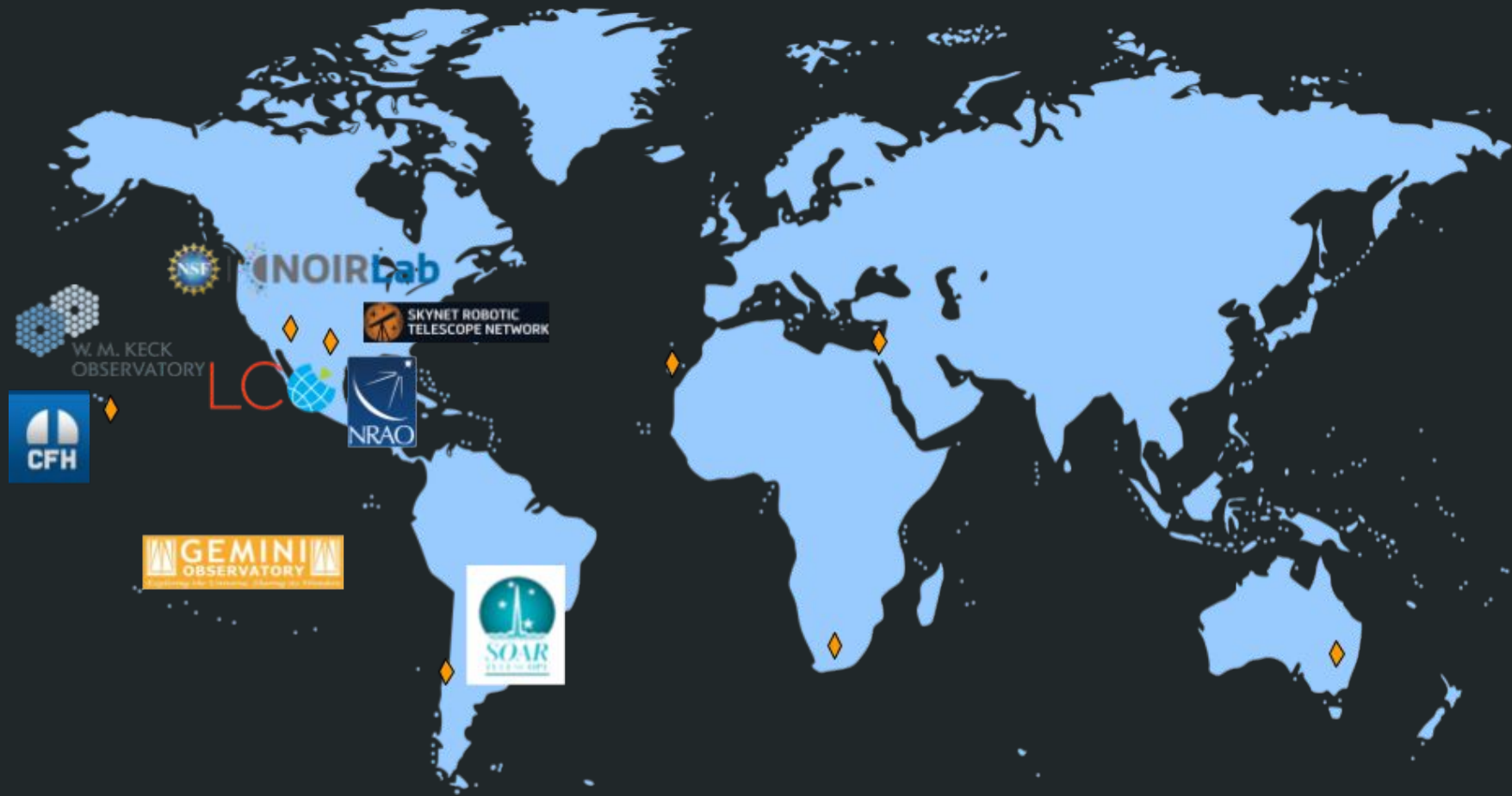


Supported by the National Science Foundation under Grant No. 2432266. Image credit: LCO

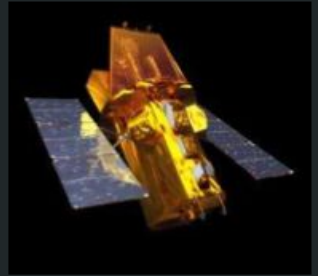
Optimize telescope operations and astronomer experience for time domain observations *across all wavelengths*

- Enable follow-up of discovery alerts
- Minimize workload and disruption from ToOs
- Maximize flexible and responsive modes of observations at different timescales
- Software tools for convenient workflow

AEON+ Astronomical Events Observatories Network



AEON+ Compatible Facilities



Neil Gehrels Swift
Space Telescope

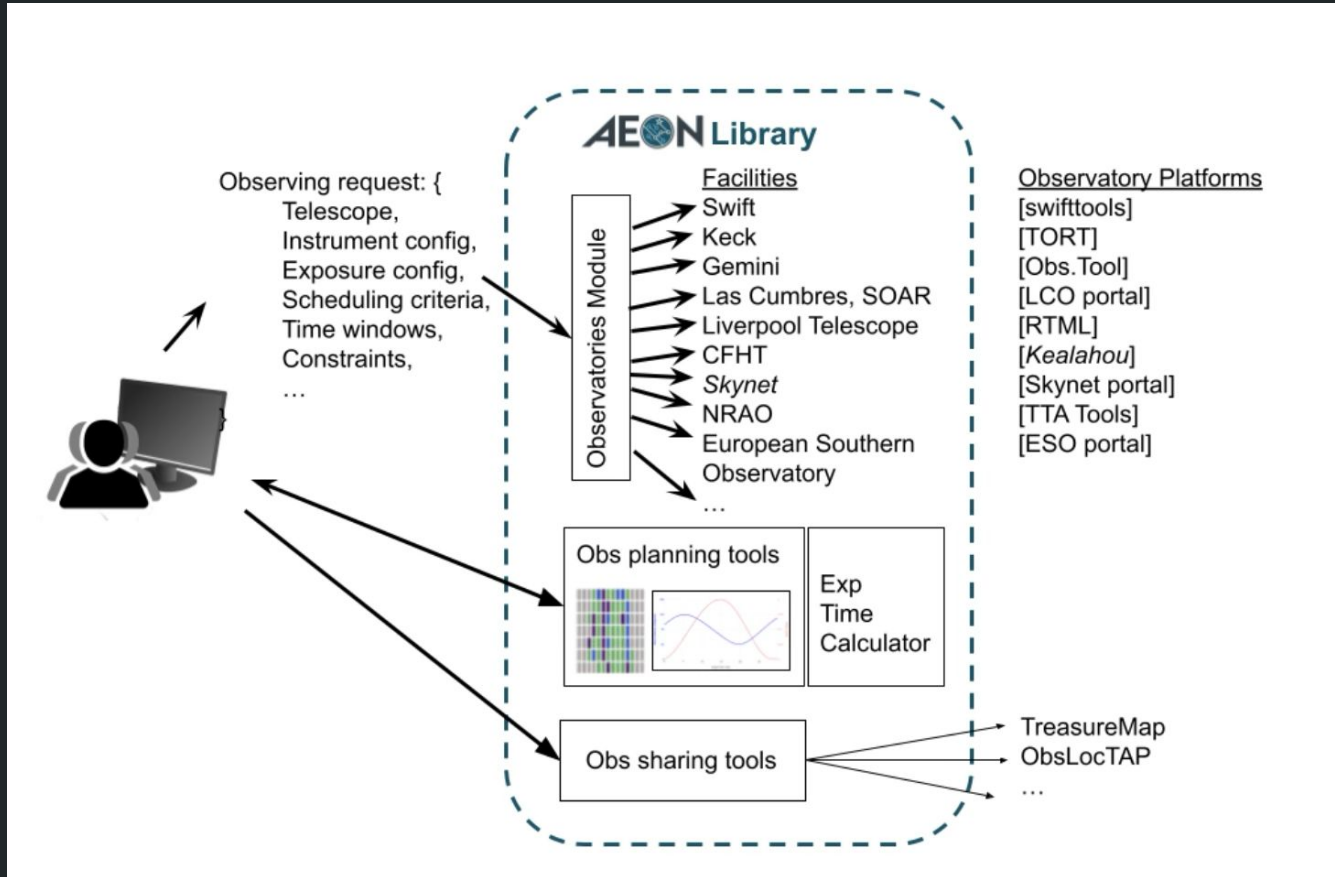
Work in progress:
Blanco 4m
Rubin In Kind
Telescopes

AEON+ : Extending AEON for multiwavelength follow-up

New NSF-supported program to expand the AEON Network

- New telescopes to be AEON compatible:
 - Canada-France-Hawaii Telescope 3.6m
 - Keck 10m
 - SkyNet Telescope Network (optical and radio facilities)
 - US National Radio Astronomical Observatory facilities
- CFHT software development for APIs and rapid ToO
- AEON+ standalone-library for observatory interfaces

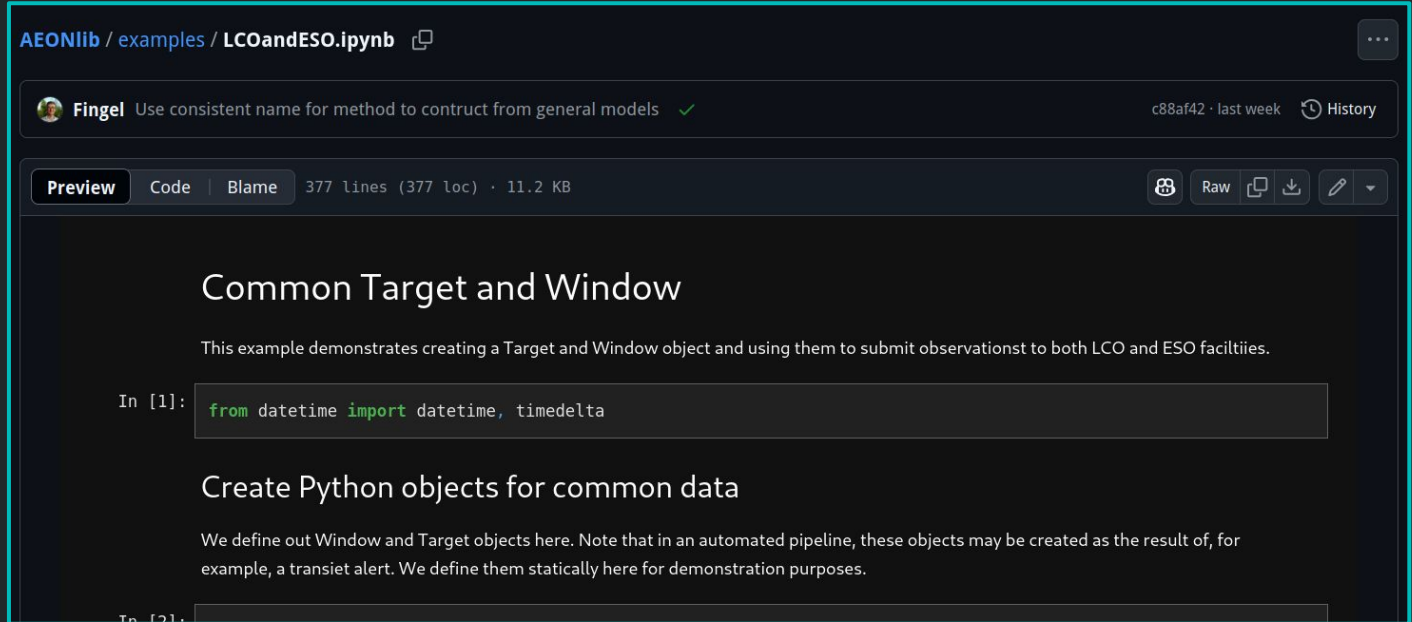
AEON+: Providing a uniform interface across telescopes



AEONlib: example Jupyter notebook: LCO and ESO submission

Demonstrates using common Target and Window data for submission to LCO and ESO.

This is early-stage development.



The screenshot shows a Jupyter Notebook interface for a file named 'LCOandESO.ipynb'. The notebook is in 'Preview' mode, showing the following content:

Common Target and Window

This example demonstrates creating a Target and Window object and using them to submit observations to both LCO and ESO facilities.

```
In [1]: from datetime import datetime, timedelta
```

Create Python objects for common data

We define our Window and Target objects here. Note that in an automated pipeline, these objects may be created as the result of, for example, a transient alert. We define them statically here for demonstration purposes.

In [2]:

Autocompletion from pydantic

```
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197  ▾ Lco1M0ScicamSinistroConfig(
198     exposure_count=1,
199     optical_elements=ElementConfig(),
200     exposure_time=20,
201     )
202
```

Validation

Accidentally setting exposure count to -3:

```
pydantic_core._pydantic_core.ValidationError: 1 validation error for Lco1M0ScicamSinistroConfig
exposure_count
  Input should be greater than 0 [type=greater_than, input_value=-3, input_type=int]
  For further information visit https://errors.pydantic.dev/2.11/v/greater_than
```

Client side logic prevents submitting invalid data to remote services which might contain their own bugs, or that have unexpected behavior when provided with unexpected values.

SCIMMA: Scalable Cyber Infrastructure for Multi-Messenger Astronomy



About ▾ Services ▾ Community ▾ Contacts ▾

[Health](#)

[Metrics](#)

[Sign up/Login](#)

SCiMMA

Scalable Cyberinfrastructure to support Multi-Messenger Astrophysics

About SCiMMA

The goal of the *Scalable Cyberinfrastructure to support Multi-Messenger Astrophysics (SCiMMA)* project is to identify needed technical infrastructure through community engagement efforts, and then support these requirements by developing the required cyberinfrastructure and software systems. SCiMMA development projects draw on collaborations among astronomers, computer scientists, and data scientists.

Multi-Messenger Astrophysics (MMA) signals are often transient, originating from distinct celestial events, making a rapid response to an MMA event a key capability. The response may include a fast analysis by a distributed science group; assembly of historical observations; determining the instruments available for new, prompt follow-up observations; instantiating the observations; and resolving conflicting requirements for similar observations from multiple science groups.

SCiMMA is working to provide interoperating cyberinfrastructure to rapidly coordinate, combine, and analyze the large-scale distributed data from all these sources. The infrastructure must accommodate public communications (of interest to the community) and protected internal communications (to support work internal to a collaboration).

The collection of SCiMMA services increasingly satisfy the community's needs for Cyberinfrastructure. The OpenMMA forum provides an addition venue to assess progress and needs.

New to SCiMMA? - a quick look at SCiMMA services

[Read More](#)

OpenMMA is a community forum to facilitate the exchange of information related to multi-messenger astrophysics (MMA) and is open to all.

[Read More](#)

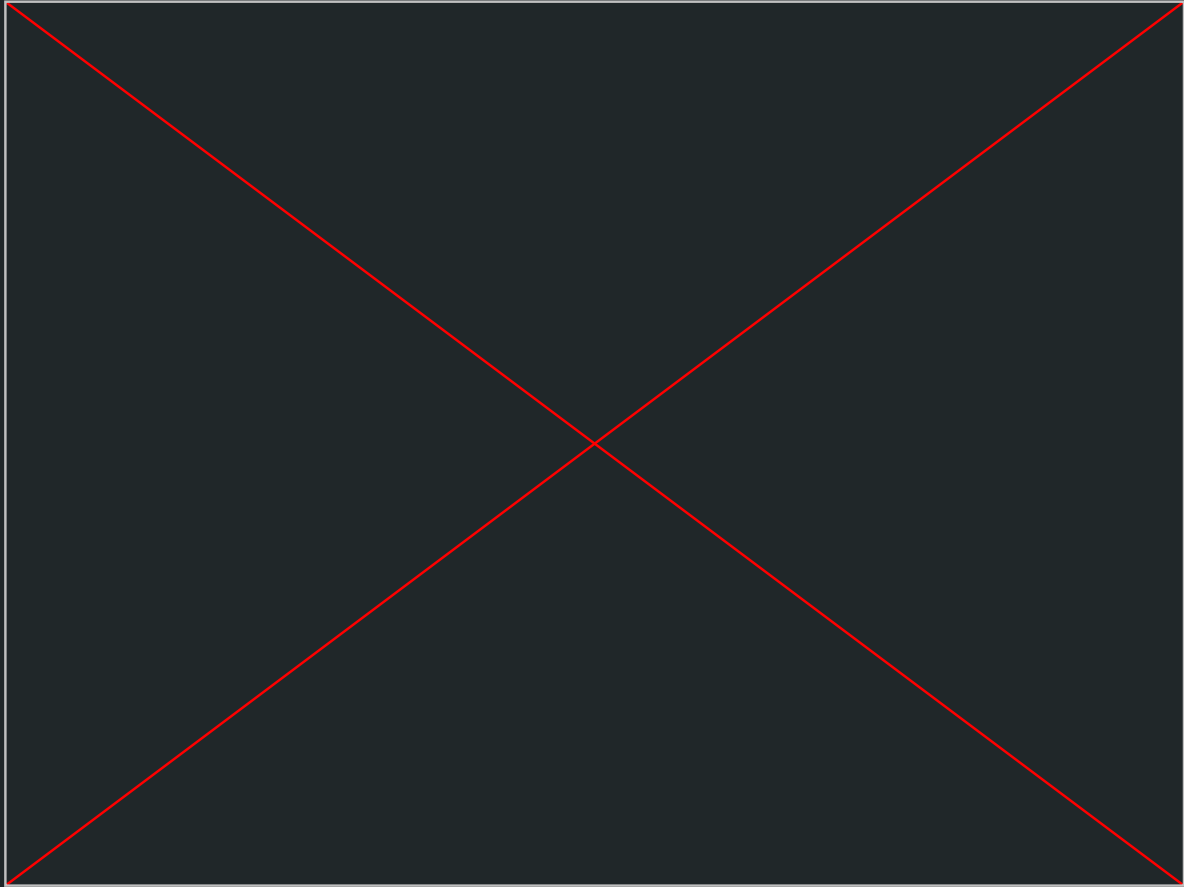
LVK run04 is live, how to access LVK alerts, and build a follow-up system.

[Read More](#)

HEROIC is a new project to facilitate Target of Opportunity Observations.

[Read More](#)

HEROIC



Where to find more information about AEON+ and AEONlib

- <https://noirlab.edu/public/projects/aeon/>
- <https://lco.global/aeon/>
- Project webpage
 - <https://aeonplus.github.io/>
- GitHub Organization
 - <https://github.com/AEONplus>
 - project board, AEONlib repo, etc.

Extra Slides

Keck Telescopes

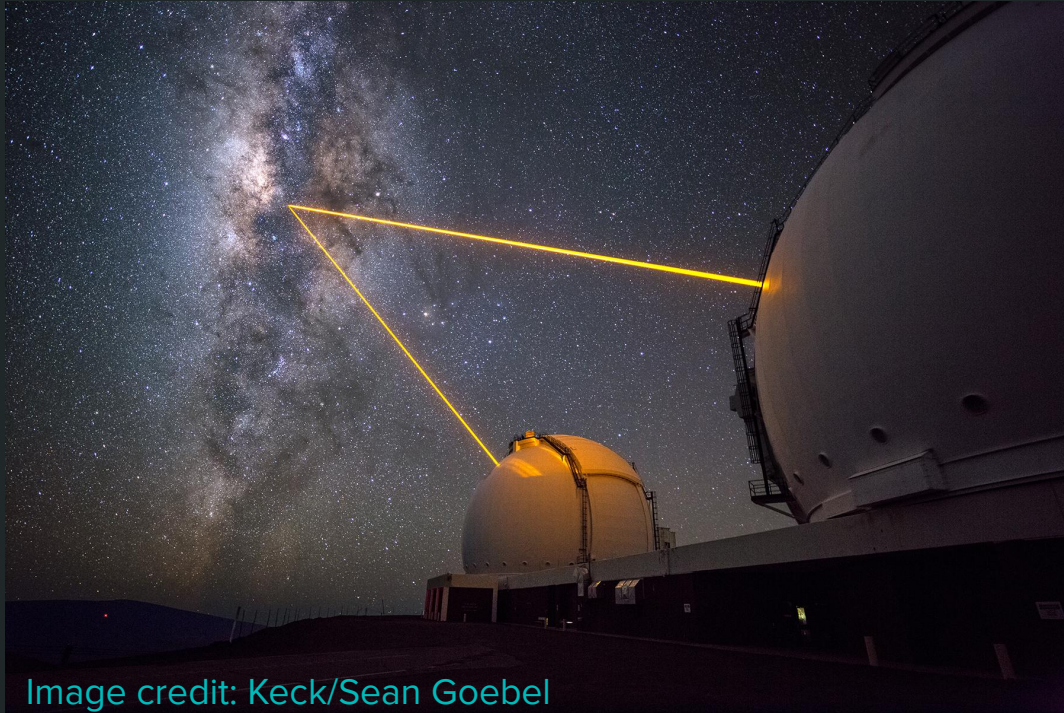


Image credit: Keck/Sean Goebel

Keck twin 10m telescopes

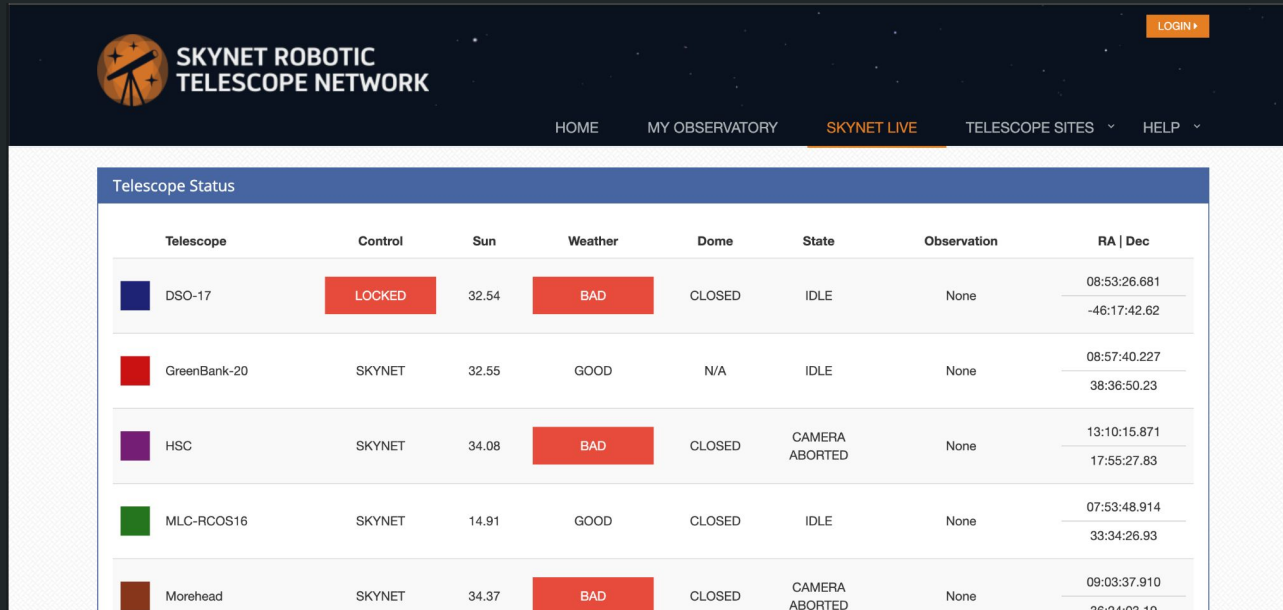
Optical/NIR instrumentation

Mauna Kea, Hawai'i

Recently announced API for
observation submission

AEONlib module under dev

Skynet Telescope Network



The screenshot shows the Skynet Telescope Network website. The header includes the logo and navigation links: HOME, MY OBSERVATORY, SKYNET LIVE, TELESCOPE SITES, and HELP. A LOGIN button is in the top right. The main content is a 'Telescope Status' table with the following data:

Telescope	Control	Sun	Weather	Dome	State	Observation	RA Dec
DSO-17	LOCKED	32.54	BAD	CLOSED	IDLE	None	08:53:26.681 -46:17:42.62
GreenBank-20	SKYNET	32.55	GOOD	N/A	IDLE	None	08:57:40.227 38:36:50.23
HSC	SKYNET	34.08	BAD	CLOSED	CAMERA ABORTED	None	13:10:15.871 17:55:27.83
MLC-RCOS16	SKYNET	14.91	GOOD	CLOSED	IDLE	None	07:53:48.914 33:34:26.93
Morehead	SKYNET	34.37	BAD	CLOSED	CAMERA ABORTED	None	09:03:37.910 36:24:22.10

Image credit: UNC/Skynet

Network of 20 observatories coordinated from UNC

Optical telescopes + single-dish radio facilities

Programmatic interface

Operates all major US radio facilities, including

- ALMA,
- ngVLA
- Greenbank and more

Developing API for
observation requests



Image credit: NRAO

Canada-France-Hawai'i Telescope



3.6m telescope, optical+NIR instrumentation

Mauna Kea, Hawai'i

100% queue-scheduled

Developing *Kealahou* API for obs submission

Developing rapid (<12hr) ToO capability

Image credit: CFHT/Cuillandre



Kealahou

Aloha, Rachel Street!

Current Account Information

Username **rstreet**

First Name **Rachel**

Last Name **Street**

Email **rstreet@lco.global**

Institute **Las Cumbres Observatory**

Country **USA**

Information incorrect? [Update it!](#)

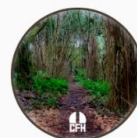


K1 Kealahou Phase 1 Tool

K1, the Kealahou Phase 1 Tool

K1 has been developed to provide observing proposal submission and review for all five CFHT instruments: ESPaDOnS, MegaCam, SITELLE, SPIRou, and WIRCam.

K1 is used for proposal submission and review by NRC (Canada), CNRS (France), ASIAA, and NAOC, as well as



K2 Kealahou Phase 2 Tool

K2, the Kealahou Phase 2 Tool

K2 has been developed for preparing Queued Service Observations (QSO) for ESPaDOnS, MegaCam, and SPIRou. SITELLE and WIRCam use the [Legacy PH2 Tool](#).

K2 Tutorials

Kealahou system

Currently supports observation requests for ESPaDOnS and SPIRou

Adding support for MegaCam

AEON+ will enable Kealahou access by external observers

Kealahou rToO

Target of Opportunity requests currently require 12hr+ notice

AEON+ includes the development of a rapid ToO process which will enable ToO requests to override science operations in progress, reducing this notice period to minutes.

AEON+ Tasks for CFHT

- Activity 1: Expand and secure the APIs necessary for users to retrieve a list of available templates and submit target and observation timing information to Kealahou.
- Activity 2: Implement the Rapid Target of Opportunity (rToO) capability for Kealahou.
- Activity 3: Document and publish the API definition.
- Activity 4: Develop AEONlib module for observation requests

AEON+ Workshops and Visiting Developer Program

- Annual workshops for observatory operators to encourage sharing of experience and tools
- Enable visits to LCO HQ for observatory and community developers