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Representing AEON Partners

Hot-wiring the Transient Universe 2019, Northwestern University, Evanston, IL, USA, Aug 19-22, 2019
THE SYSTEM

AEON:
Astronomical Event Observatory Network

"Here is an event"
"Here is what I learned"
"Request everything matching these criteria"
“Observe X with parameters Y”
“Tell me status of X”
“Send me data of X”

Survey 1
Survey 2
Survey 3

BROKER 1
BROKER 2...

TOM 1
TOM 2...

SOAR

Observation interfaces + scheduler(s)

More facilities joining later on...

Target Observation Managers contain the science logic.

Brokers aggregate alerts with catalogs and classify.
AEON on SOAR

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AEON
Astronomical Event Observatory Network

Rapid, flexible, programmable access to world-class telescope facilities

Modern astronomical surveys can now deliver tens of thousands of new discoveries every night, alerted within minutes. Yet many will require additional observations in order to understand the physical phenomena and maximize the scientific return. Observatories providing this critical follow-up must become capable of responding on similar timescales and with a flexibility governed by the demands of the science.

AEON will be a collection of world-class telescope facilities which can be accessed on demand, at the touch of a button. At the heart of the network, LCO is joining forces with the NOAO and the SOAR 4.1m and Gemini 8m telescopes to build...
Software Architecture - SOAR end

SOAR Queue Manager (SQM) – Python 3 & MongoDB

Manages communications with LCO via APIs
- Fetches updated schedule
- Publishes SOAR status to network: available/offline (non-TD night, weather, technical)
- Updates status of latest observation: success/failed (technical, exceeded time, other)

Parses info block for each new target to Goodman command server

TCP/IP TO INSTRUMENT

SQM web interface
Javascript (NodeJS, ReactJS)
- Connect to LCO
- Queue status monitoring
- Tools for running queue in local mode (engineering or classical nights)

Goodman command server (LabView)

Telescope Control System (TCS)
Goodman High Throughput Spectrograph (GHTS): highly configurable imaging spectrograph. Limited configs available for AEON.

- **Two low-res spectroscopic modes (R~900):**
  - 400M1: 400 l/mm grating, **300-700nm**, 1” slit, 2x2 binning
  - 400M2: 400 l/mm grating, **500-900nm**, 1” slit, 2x2 binning

- **One Hi-res mode (R~12000):** 2100 l/mm grating, 0.45” slit, centered @ 650nm (63nm coverage), 1x1 binning

- **Imaging Mode:** 2x2 binning, SDSS-\(g, r, i\), and a wide VR filter

- **Atmospheric Dispersion Corrector (ADC) always IN**

- **Guide Star and on-slit target acquisition:** manual

- **Calibrations:** scripted, run every afternoon by SOAR staff.
Observation Requests

**Duration of Observation Request:**

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<th>Name</th>
<th>Proposal</th>
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**Mode:** Queue scheduled (default)

**IPP Factor:** 1.05

**Observation Type:** Image

**Instrument:** 1.0 meter Sinistro

**Acceptability Threshold:** 90

**Guiding:** Optional

**Instruments Configuration**

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**AEON operation on SOAR**

**Start:** Telesc. Operator/Obs (TO) opens dome, inits telesc pointing/AOS, starts SQM

**SQM Web Interface:**
*Connects to LCO scheduler, front-end for SOAR TO.*
(Add-on→does not replace GHTS GUI)

OFFLINE MODE, independent of LCO → upload and manage queue directly. Useful automation tool also for classically-scheduled observers.

**Operation:** TO oks slews >15 deg, acq guide star & target on-slit, stops SQM.
SOAR started observations in AEON-mode for 2019B semester on Aug 6

8 science programs, 200h (~20 nights) spanning range of science cases:
- Search and characterization of Near-Earth Asteroids (NEOs)
- Follow up observations of Gravitational Wave candidate optical counterparts
- Characterization of micro-lensing events in our Galaxy
- Search for RR Lyrae stars in faint dwarf galaxies
- Characterization of Supernovae
- Characterization of young stars in star-forming regions
AEON on SOAR: 2019B first results

FIRST NIGHT: AUG 6
- 11.4h night length: ~ 9h of AEON operations scheduled
- 53 observations, 12 targets under clear sky, good seeing (~0.5-1")
- ~6h open shutter time on science targets (~65%)

SECOND NIGHT: AUG 10
- Lost: weather (70%); CTIO-wide internet connectivity failure (30%).
- 1 target observed through clouds, poor SNR.
AEON on SOAR: what’s next

2020A
• Increase supported configurations

• Implement automatic data reduction pipeline: full spectroscopic pipeline exists but only as offline version.

• Extend to non-NOAO partners consistent with interest

• Use statistics from 2019B and early 2020A to plan for subsequent operations
Las Cumbres is organizing a program to promote TOM Toolkit development and use.


**Goals:**
- Give astronomers an interactive introduction to the TOM Toolkit, a software package for building and customizing Target and Observation Manager systems.
- Enable scientists to provide input about the scientific requirements for TOM systems and interfacing services (i.e., alert brokers, telescope facilities, data archives).
- Facilitate communication between scientists, TOM developers, and developers of interfacing services regarding the needs of scientists.
- Stimulate the application of the TOM Toolkit for alert-based science by providing ongoing access to key resources through a competitive proposal process.

**Managing Follow-up Observations in the Era of ZTF and LSST**

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https://lco.global/tomtoolkit/