Tools and services for alert follow-up programs



Presenter: R. Street, W. Lindstrom, J. Chatelain, J. Nation, C. McCully, A. Howell In collaboration with SCIMMA



Time domain science depends on a network of software services



Image credits: Rubin Obs/AURA, Gaia/ESA, LIGO/Virgo/Kagra, IceCube, ANTARES, Alerce, Fink, Lasair, MPC, Gemini, LCO, NASA/Swift

Target and Observation Manager Systems



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Software to manage all aspects of science programs

Interface directly with services inc. telescopes, alert brokers and archives

Open-source packages available:

TOM Toolkit

🕒 SkyPortal

Black Hole TOM system by Maja Jobłońska, Łukasz Wyrzykowski, Poland Built with TOM Toolkit

TOM Toolkit - New Tools for Alert Based Science

- tom_alertstreams: New app to enable TOM to listen to Kafka streams
- tom_classifications: Tool for comparing and visualizing alert classifications from brokers
- tom_nonlocalizedevents: New app for GW, neutrino detections



New app to enable TOM to listen to Kafka streams

```
'CONFIG': { ... },
```



tom_classifications

By Brendan Mills, UCSB



Non-localized events

Support for events with extended localization regions, often include many candidates

Synthesize data from many observers

Many teams observing those candidates can duplicate observations of some candidates while neglecting others

⇒ Sharing observations helps to ensure a more thorough search for counterparts

Data sharing between teams

Independent research teams want to share results and coordinate Different teams run independent TOMs/Skyportal/own software





🛣 HERMES Submit New Non-localized Event Submit Candidates Submit Non-Detections Submit Search Pointings Report Photometry Report Spectroscopy Report Observatory Availability

Candidate Submission Form

AT2020				Title:						Topic:				
AI ZUZUV	AT2020vr, AT2020vt, AT2020wa and AT2020wc 10.4m GTC spectroscopy					herm	hermes.test							
Event ID:			Authors:											
S200114	f		A. F. Valeev (SAC	D-RAS), YD. H	lu, A. J. Castro-	-Tirado a	nd E. Fernand	ez-Garcia (IAA-CSIC),	V. Sokolov (SAO-RA	S), I. Carrasco	and A. C	astellon (UM/	A), S. B. Pan	
ID	RA	Dec	Discovery Date	Telescope	Instrument	Band	Brightness	Brightness Error	Brightness Unit		Addition	nal Data Elem	ents:	
AT2020vr	07:34:06.13	+16:46:00.51	58862.15	ztf	ztf	g	20.9	0.209	AB mag	T	Key	Value		
AT2020vs	07:24:28.50	+16:12:45.85	58862.15	ztf	ztf	g	21.4	0.214	AB mag		email	ajct@iaa.es		
AT2020vu	07:16:47.14	+10:37:18.97	58862.15	ztf	ztf	g	21.6	0.216	AB mag					
AT2020wc	07:03:22.07	+27:22:41.21	58862.16	ztf	ztf	g	20.7	0.207	AB mag		Add R	low		
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https://hermes.lco.global



Scalable Kafka-based streaming service for MMA developed by SCIMMA.org in collaboration with LCO



Flexible new message service where users can share almost any data

Machine readable

GUI + API submission

Supports submission to GCN Classic over Kafka via email



This material is based upon work supported by the National Science Foundation under Grant No. AST-2311355

Coordinating Observations

\leftrightarrow \rightarrow C $_{\hat{n}}$ treasuremap.space

TM Home GW Events. Query Pages + Submit Pages + Documentation + Profile Logout
If you are using our APL, you must update your base URL to "https".

Gravitational Wave Treasure Map
Welcome! The Treasure Map is designed to help coordinate electromagnetic
followup of gravitational-wave (GW) events. It allows observers to easily report

Welcome! The Treasure Map is designed to help coordinate electromagnetic followup of gravitational-wave (GW) events. It allows observers to easily report their planned and executed observations in search of counterparts to GW events, and to quary the reports of other observers, in a programatic way. The goal is to enable coordination between observatories in order to minimize unnecessary overlap in these earches, and find the counterpart as quickly and as efficiently as obsibile.

Please register for an account, so that you can programatically query the Treasure Map. For more details on how to use the Treasure Map see our User Guide.

Please direct any general inqueries to lair Arcavi, if you use the Treasure Map in your research, please cite the Treasure Map paper in addition to the circulars and/or papers of the teams whose pointing information you use.



Visualization

Visualize GW alert contours
 Submit your follow-up pointings

search community

Analyze follow-up
Images from GW190614

· Collaborate with the counterpart



Explore all GW alerts

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Treasuremap.space By Samuel Wyatt, Aaron Tohuvavohu, et al.

Enables surveys and observers to share observation pointings

GUI + API



Observatory Control System

observatorycontrolsystem.github.io

Observatory Control System Home API Documentation 🗸

Observation Submission Portal

- Configuration
 Database
- Adaptive Scheduler for telescope time
- Science Data Archive
- Downtime Database

compatible

Observatory Control System

Open source software for an API-driven observatory

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Contributing

Code of Conduct Contributor Guidelines Components Observation Portal Configuration Database Adaptive Scheduler

Science Archive

With the field of astronomy undergoing a revolution in data volume and automation, many observatories around the world are beginning to update their systems to take advantage of modern web technologies. However, producing a fully-featured and maintainable Observatory Control System (OCS) is an expensive undertaking! Las Cumbres Observatory successfully operates a network of 20+ robotic telescopes around the world, driven entirely by APIs. The software that enables this has been bundled up and open-sourced, the goal of which is to increase the rate of adoption of APIs in astronomical observing and to share the knowledge gained in the process of building the software so that the entire community benefits.

What does an API-driven Observatory Control System accomplish?

Astronomers can:

- Submit requests to observe a target, track the states of those requests, and cancel requests if their needs have changed
- Be notified once their observation is complete
- Download their science data



Hands-on workshop for observatories interested in enabling Time Domain Astrophysics with AEON-compatible flexible observing modes and software tools

Sept 23-24, 2023

Co-located with LSST@Europe V in Poreč, Croatia







A suite of open-source tools and services to enable alert-driven observing programs and data sharing.

Come talk to our team if you'd like to learn more!



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https://tom-toolkit.readthedocs.io/
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https://hermes.lco.global/

TreasureMap
https://treasuremap.space/

OpenOCS

https://observatorycontrolsystem.github.io
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Extra Slides

🔆 HERMES Submit New Non-localized Event Submit Candidates Submit Non-Detections Submit Search Pointings Report Photometry Report Spectroscopy Report Observatory Availability

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1	2	2022/07/26	Title		Hermes User.guest	
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Fermi trigger No 680421061: Global MASTER-Net observations report

Vladimir Lipunov at Moscow State U/Krylov Obs <lipunov@xray.sai.msu.ru>

V. Lipunov, V.Kornilov, E.Gorbovskoy, K.Zhirkov, N.Tyurina, P.Balanutsa, A.Kuznetsov, D. Vlasenko, G.Antipov, D.Zimnukhov, V.Senik, E.Minkina, A.Chasovnikov, V.Topolev, D.Kuvshinov, D.Cheryasov, Ya.Kechin (Lomonosov Moscow State University, SAI, Physics Department),

R. Podesta, C.Lopez, F. Podesta, C.Francile (Observatorio Astronomico Felix Aguilar OAFA),

R. Rebolo, M. Serra (The Instituto de Astrofísica de Canarias),

D. Buckley (South African Astronomical Observatory),

O.A. Gres, N.M. Budnev (Irkutsk State University, API),

L.Carrasco, J.R.Valdes, V.Chavushyan, V.M.Patino Alvarez, J.Martinez, A.R.Corella, L.H.Rodriguez (INAOE, Guillermo Haro Astrophysics Observatory),

A. Tlatov, D. Dormidontov (Kislovodsk Solar Station of the Pulkovo Observatory),

A. Gabovich, V.Yurkov (Blagoveschensk Educational State University)

MASTER-OAFA robotic telescope (Clobal MASTER-Net: http://observ.pereplet.ru, Lipunov et al., 2010, Advances in Astronomy, vol. 2010, 30L) located in Argentina (OAFA observatory of San Juan National University) started inspect of the Fermi

TOM sharing data via Hermes

SNEx 2.0 Home Targets - Aler	ts • Scheduling Data Users TNS T	Search by name or coor	Curtis McCully	
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