Object ~~Visibility~~ Observability SAP Status

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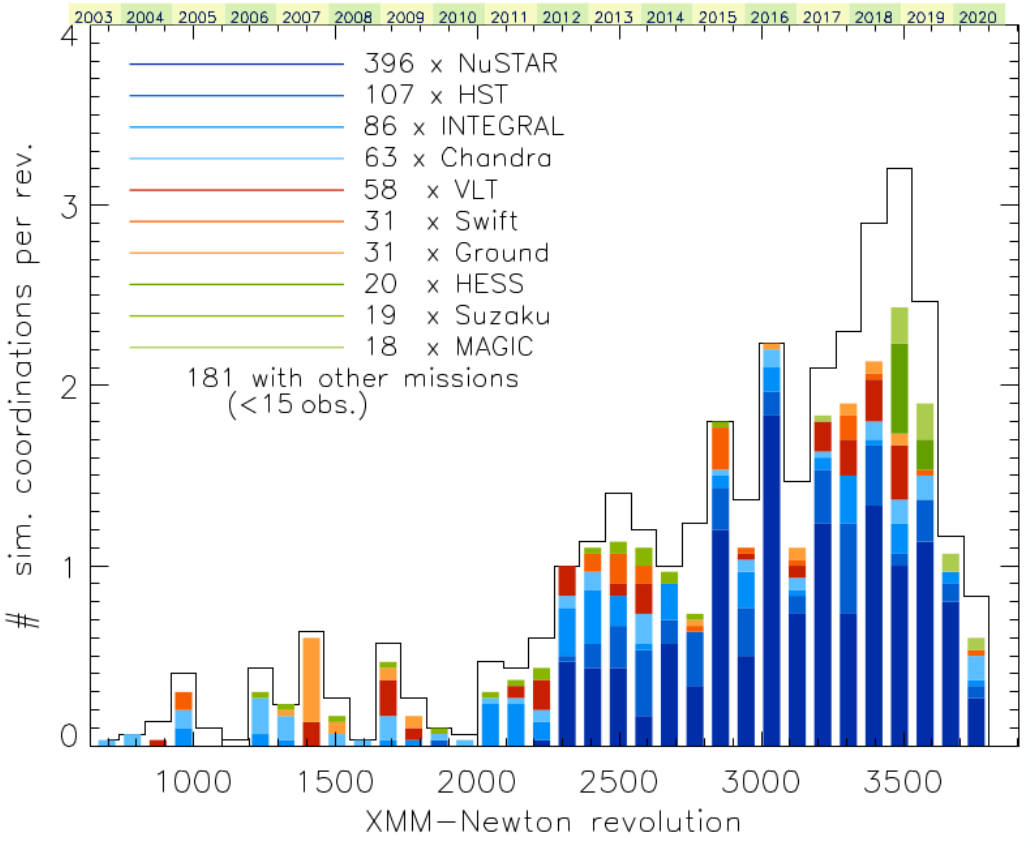
Overview

1. Brief Object ~~*Visibility*~~ *Observability SAP* Introduction
2. Main goal
3. Current Status
    1. Visibility Concept Revision
4. Next steps

Brief Object ~~*Visibility*~~ *Observability SAP* Introduction

- **Demand for coordinated observations is increasing…**

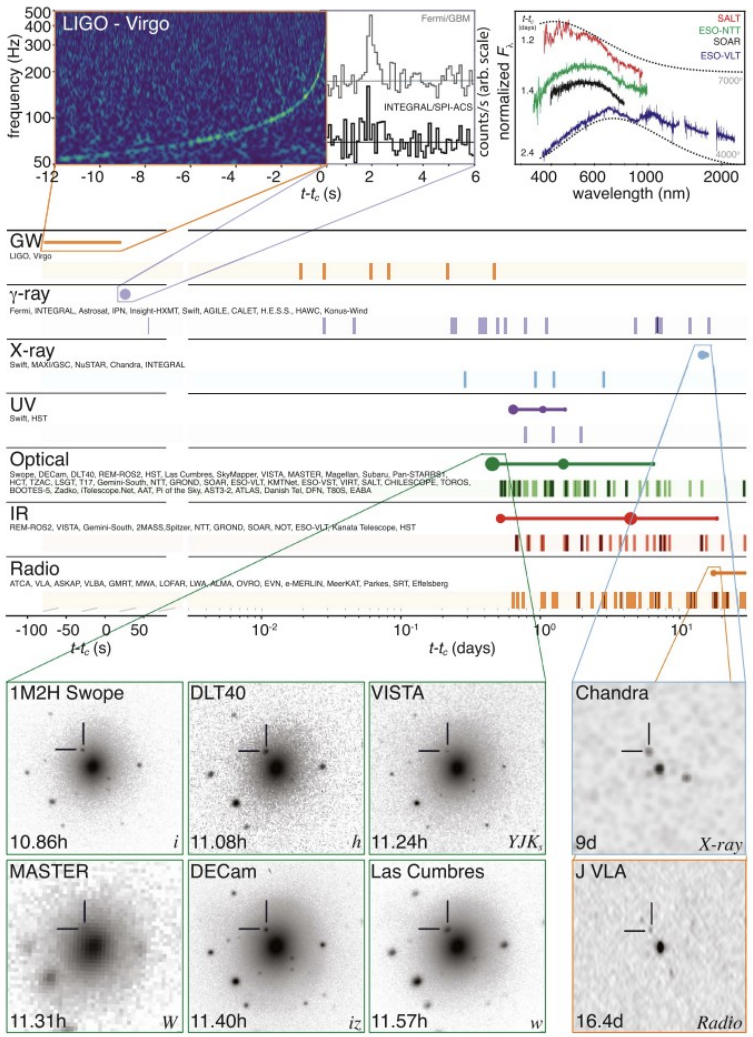
- **Some observatory numbers:**
  - **NuSTAR: ~30% of the observations are coordinated with other observatories.**
  - **XMM-Newton: ~15% coordinated observations (NuSTAR, HST, Chandra, VLT, Swift).**
  - **INTEGRAL: ~10% of the observations are coordinated with other observatories.**

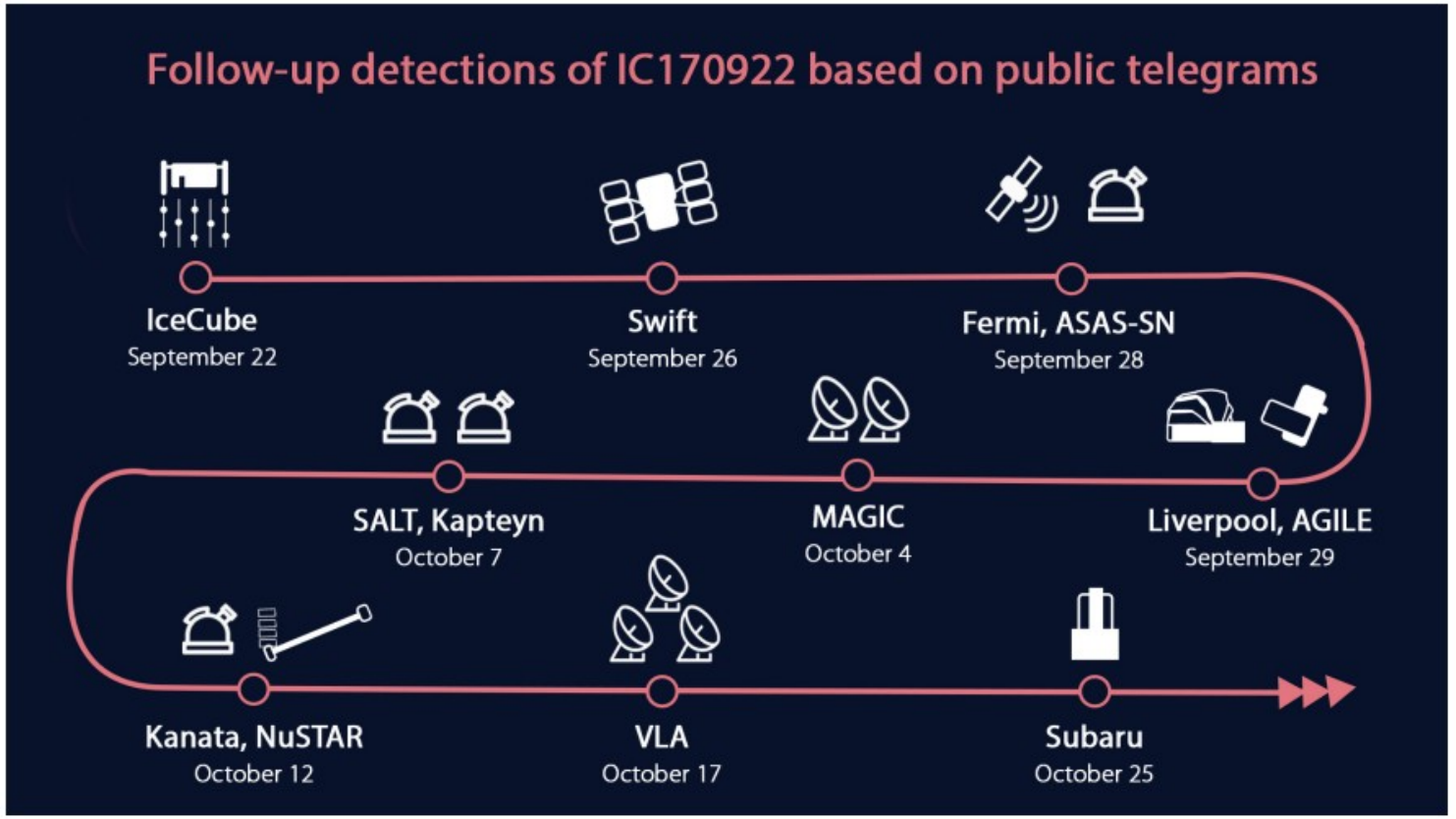


Brief Object ~~*Visibility*~~ *Observability SAP* Introduction

The NASA Multi-Messenger Astrophysics Science Support Center (MOSSAIC)*

Sambruna et al. (April 2022)





Brief Object ~~Visibility~~ *Observability SAP* Introduction

Time-Domain and Multi-Messenger Astronomy – HEAD 2023

TDAMM General Observer Facility Study Activities

The study team is engaging stakeholders throughout the science lifecycle, seeking to identify opportunities where enhanced coordination would improve efficiency or TDAMM scientific outcomes.

Strategic Coordination	Tactical Coordination	Operational Coordination	Archival Coordination
Timescale: 1+ Years	Timescale: Hours-Months	Timescale: Seconds-Hours	Timescale: Permanent
• Establish & sustain a TDAMM Call for Proposals • Engage PhysPAG/SIG/SAGs to identify and validate science cases and follow-up observation needs. • Establish & sustain a common architecture for coordinated space-based follow-up operations. • Advise new missions about TDAMM Astrophysics Enterprise interfaces and best practices. • Support Senior Review Board, Decadal and other strategic planning activities.	• Survey the existing coordination fora and agreements among missions. • Survey the set of tools used by General Observers to construct TOO requests and to predict observing parameters. • Investigate tactical mission science planning processes. • Develop and document the information flows, activities, and interfaces needed to improve tactical multi-mission coordination.	• Investigate and document the information flows, activities, and interfaces between astrophysical alert systems (e.g., GCN) and individual mission Flight, Science and Mission Operations Centers. • Identify science and mission state, status, and constraint parameters that would be needed for tactical multi-mission coordination.	• Investigate whether current archives allow sufficient metadata tagging and discovery of datasets associated with a TDAMM science proposal. • Assess whether spatial and temporal search parameters and visualizations are adequate for TDAMM archival research.

Study design includes:

- Review of the literature, regular interchanges with subject matter experts, weekly meetings with the study advisory group, site visits to science & mission operations centers, presentations to HQ.
- A mission questionnaire was recently sent out to NASA mission leads.
- A pilot for TDAMM GOF cross-mission coordination activities and technical coordination mechanisms is under consideration for the L/V/K O4 run, approximately May 2023-Nov 2024.

Brief Object ~~*Visibility*~~ *Observability SAP* Introduction

Brian Humensky	NASA's Astrophysics Cross-Observatory Science Support (ACROSS) Initiative
Michael Coughlin	A technical ecosystem to enable multi-messenger astrophysics
Shreya Anand	MMA observing campaigns with the Zwicky Transient Facility: challenges and lessons learned
Gautham Narayan	SCIMMA: Real-time Orchestration of Multi-Messenger Astrophysical Observations
Rachel Street	Tools for Time-Domain Observers: New features and development plans for the TOM Toolkit and more.
Monika Soraisam	GOATS: an end-to-end time-domain and multi-messenger astronomy platform
Griffin Hosseinzadeh	Infrastructure for Searches After Gravitational-waves Using ARizona Observatories
Sarah Antier	A french example of coordination of space and ground facilities for the multi-messenger effort
Nicholas White	Process barriers to new multi-messenger astrophysics space observatories

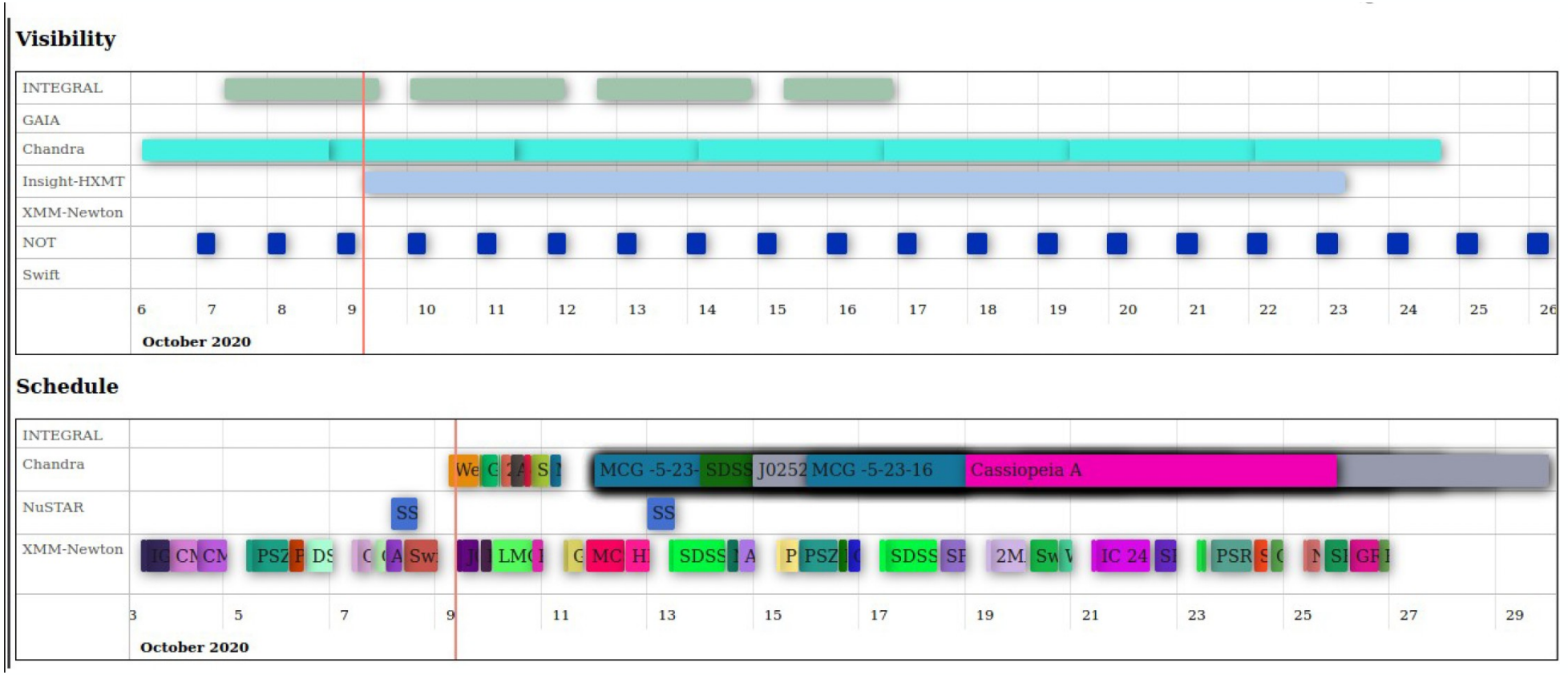
Main goal

To standaridize the retrieval of the well-known observability or contraint-free periods of astronomical targets that all facilities have

- **Follow-up observations**
- **Alerts**
- **Automated coordination**
- **Easier communication**
- **Help to plan observations**
- **…**

Current Status

- Demo workshop organized by ESAC in September 2020
- Object Visibility Simple Access Protocol already under discussion in the IVOA DAL panel.
- Prototype implementation already in place for some facilities.



Current Status

Target constraint-free time periods concept in optical, high-energy and radio astronomy is the same, but the term *visibility* is not shared by all disciplines.

<u>Visibility in radio astronomy</u>

The visibility function is the result of the Fourier Transform of the celestial brightness distribution in the sky.
It is a measure of how well the signals from a celestial source are correlated between the antennas.

Current Status

1. **SCHED is a program for planning and scheduling Very Long Baseline Array (VLBA)**

THE SCHED USER MANUAL Version 11.8, Released April 2023 (nrao.edu)

"This tries to compensate for edge stations that have no mutual visibility with the rest of the array for sources at low elevation in certain directions. The input scan to use is then selected based on the adjusted weights."

2. **VLBI scheduling software sked**

https://core.ac.uk/download/pdf/42753936.pdf

" Sked calculates the source visibility table (a table which indicates which stations can see each source). This is used to generate the universe of possible scans."

Current Status

3. **TOM toolkit**

Plugins — TOM Toolkit 1.1.0 documentation (tom-toolkit.readthedocs.io)

"tom-nonsidereal-airmass. This module provides a templatetag supporting visibility plots for non-sidereal."

4. **SPICE from JPL**

SPICE Geometry Calculator (nasa.gov)

Concepts like:

- **"target in field of view"**
- **"target in view"**

5. **Astroplan (python)**

astroplan v0.9.2.dev1+g5e4ac2c

"Determining observability of sets of targets given an arbitrary set of constraints (i.e., altitude, airmass, moon separation/illumination, etc.)."

Next Steps

We propose to change “Object Visibility” by “Object Observability” and replace in the current protocol documentation the term “visibility” by “constraint-free” or “observability”

International
Virtual
Observatory
Alliance

Object Observability Simple Access Protocol

Version ~~1.0~~ 1.1?

IVOA Working Draft 2020-09-30

Working group
Data Access Layer Group

Target
Observability
Simple
Access
Protocol
TarObsSAP