Development of the Multi-Messenger Observation Database and Viewer

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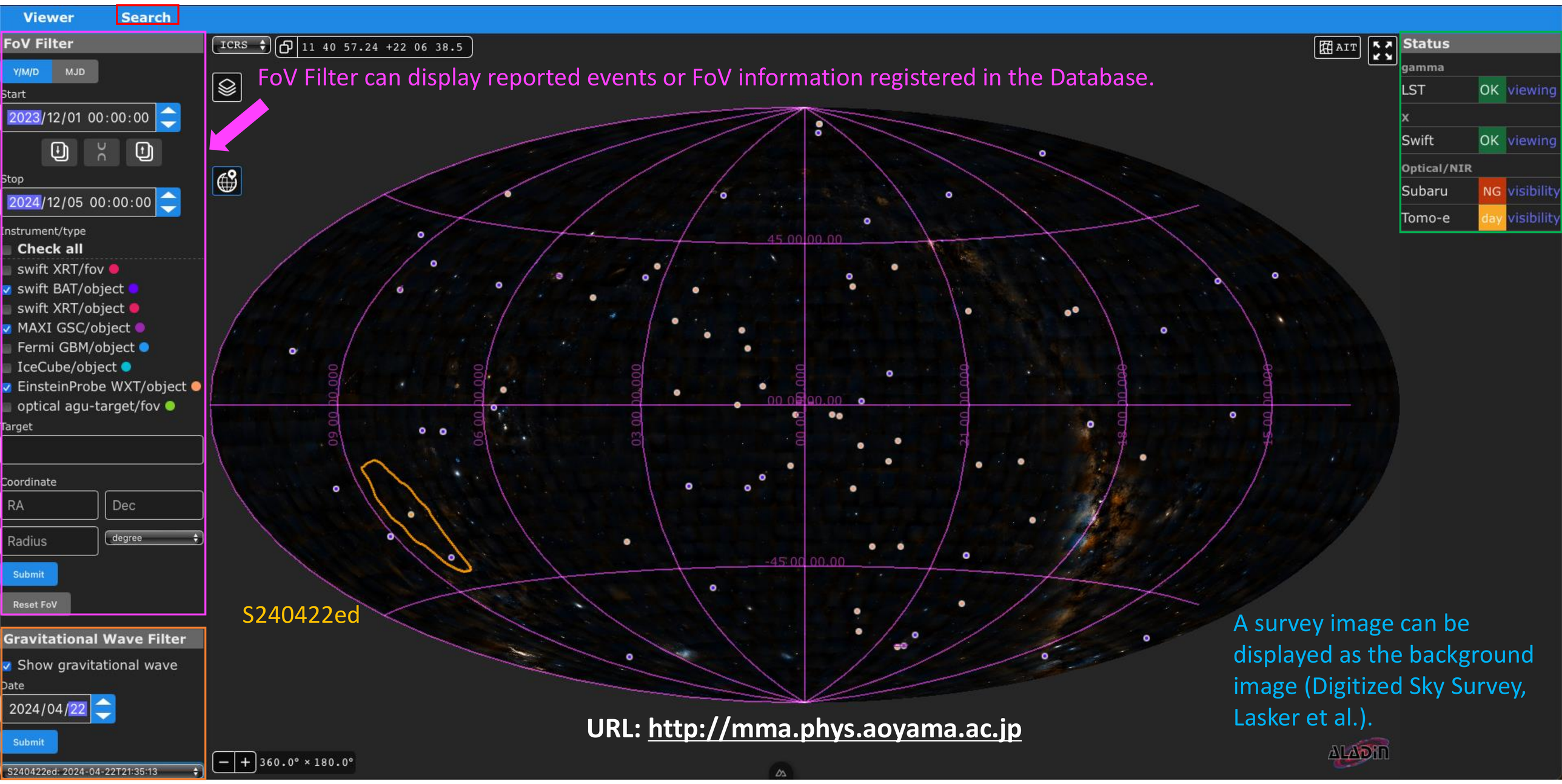
Summary: In the past two decades, multi-wavelength observations of astronomical objects and phenomena using electromagnetic waves have become commonplace. Furthermore, multi-messenger astronomy, which includes messengers beyond electromagnetic waves, such as gravitational waves and neutrinos, is emerging as the new standard. The Multi-Messenger Observation Database and Viewer compile and visualize various types of observation data, enhancing the ability to identify potential targets for multi-messenger astronomy. In particular, the viewer quickly provides information to assist in deciding whether to follow up on transients. We will introduce the Multi-Messenger Observation Database and Viewer and provide a development status.



What is the purpose?

- The Database collects & archives various data from multi-messenger observations.
- The Viewer provides information for us to schedule follow-up observations by visualizing observational data overlaid.
- Overlaid data may give us inspirations of potential targets for multi-messenger observations.

Contents of the Viewer

Survey
- Publicly available survey images

FoV Filter
- Reported events or FoV

Gravitational Wave Filter
- GW events from LIGO/Virgo/KAGRA

Status
- Sharing observation status (TBD)

Search
- Go to the Object search

Catalog
- Publicly available catalogs can be overlaid on the Viewer.
- We can put shortcuts for catalogs manually created or frequently used.

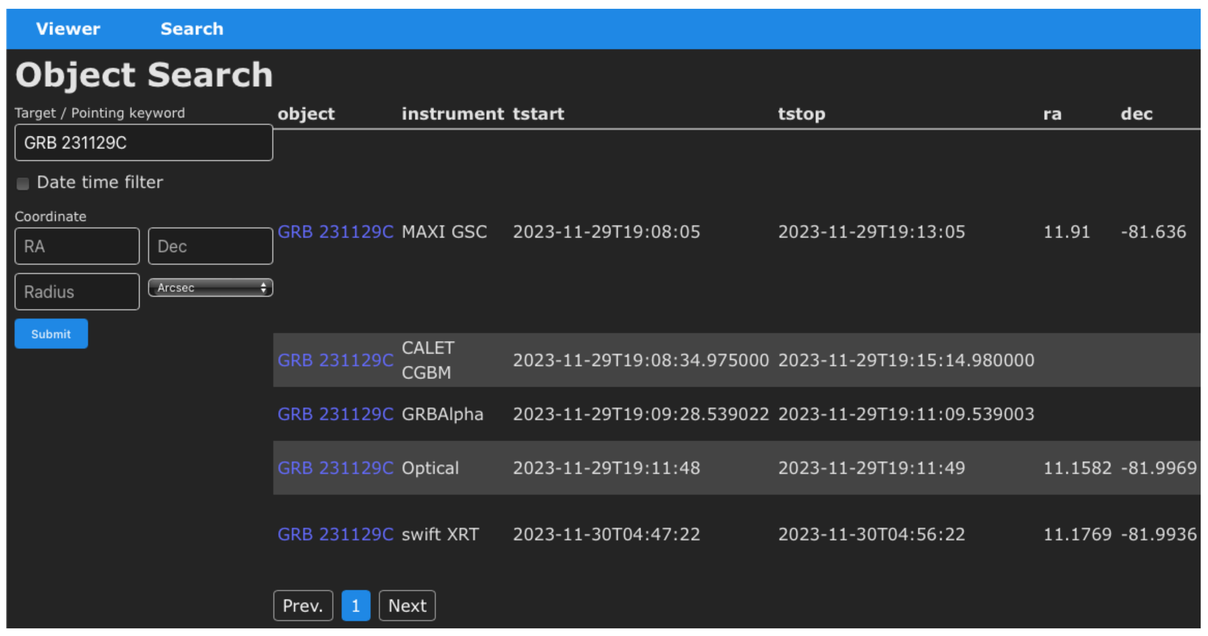
Development status

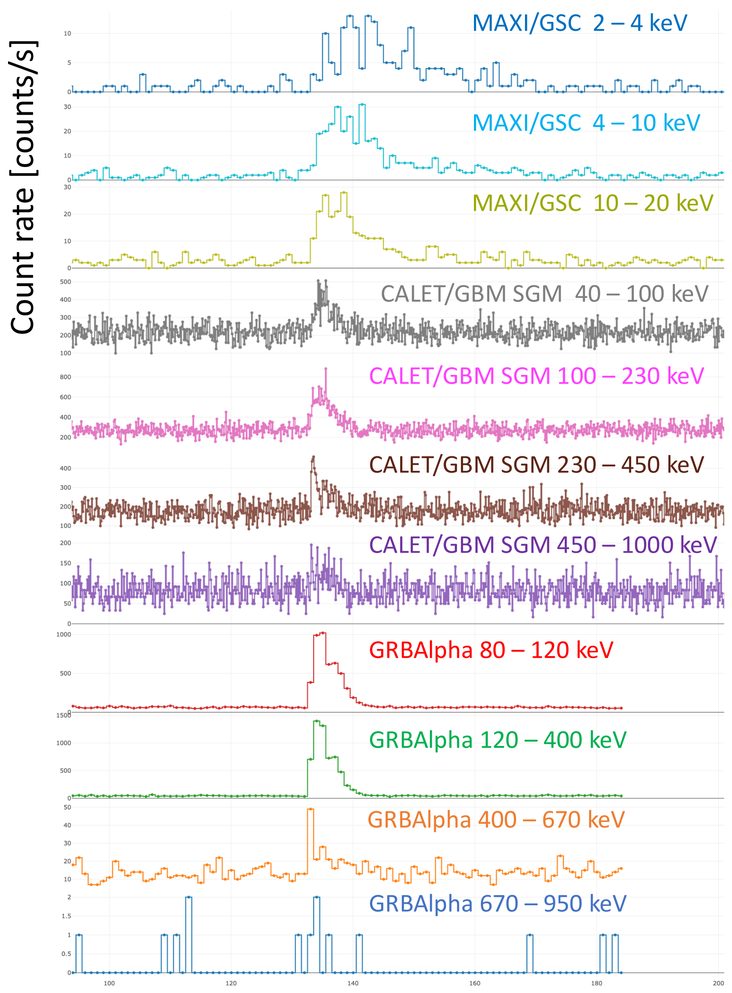
- AstroArts has already developed the main system.
  https://www.astroarts.co.jp/official/corporate/index-j.shtml
- We manage servers for the Database and Viewer at Aoyama Gakuin University.
- The data collection systems are under development for increasing data in the Database

Future works

- Enrichment of existing contents
  -- Catalogs
  -- FoV filter
  -- light curves
- Customized alerts
  -- Once the server receives alerts, the server distributes customized alerts considering the data in the Database
  e.g., list of galaxies in the MAXI's error box for GRBs

Object Search & Object Information





- The "Object Search" can search for "Object Information" recorded in the Database.
- The "Object information" can include below:
  -- light curve (count, flux)
  -- time (start, stop)
  -- R.A., Dec.
  -- link to spectrum
  -- link to image
  -- link to source
- Light curves obtained by each detector can be displayed.
- We are adding light curves of missions below to the Database: MAXI/GSC, CALET/GBM, Swift/BAT, Fermi/GBM, GRBAlpha, VZLUSAT-2.