Les hautes énergies à l'IVOA

Journées ASOV 2022

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CENTRE DE DONNÉES ASTRONOMIQUES DE STRASBOURG

IVOA

Observatoire astronomique de Strasbourg | ObAS

Index

- Le VO et l'IVOA
  - Who / Where / How / When
- Hautes energies
- Introduction de la seance dédiée aux hautes energies

The VO and the IVOA: what?

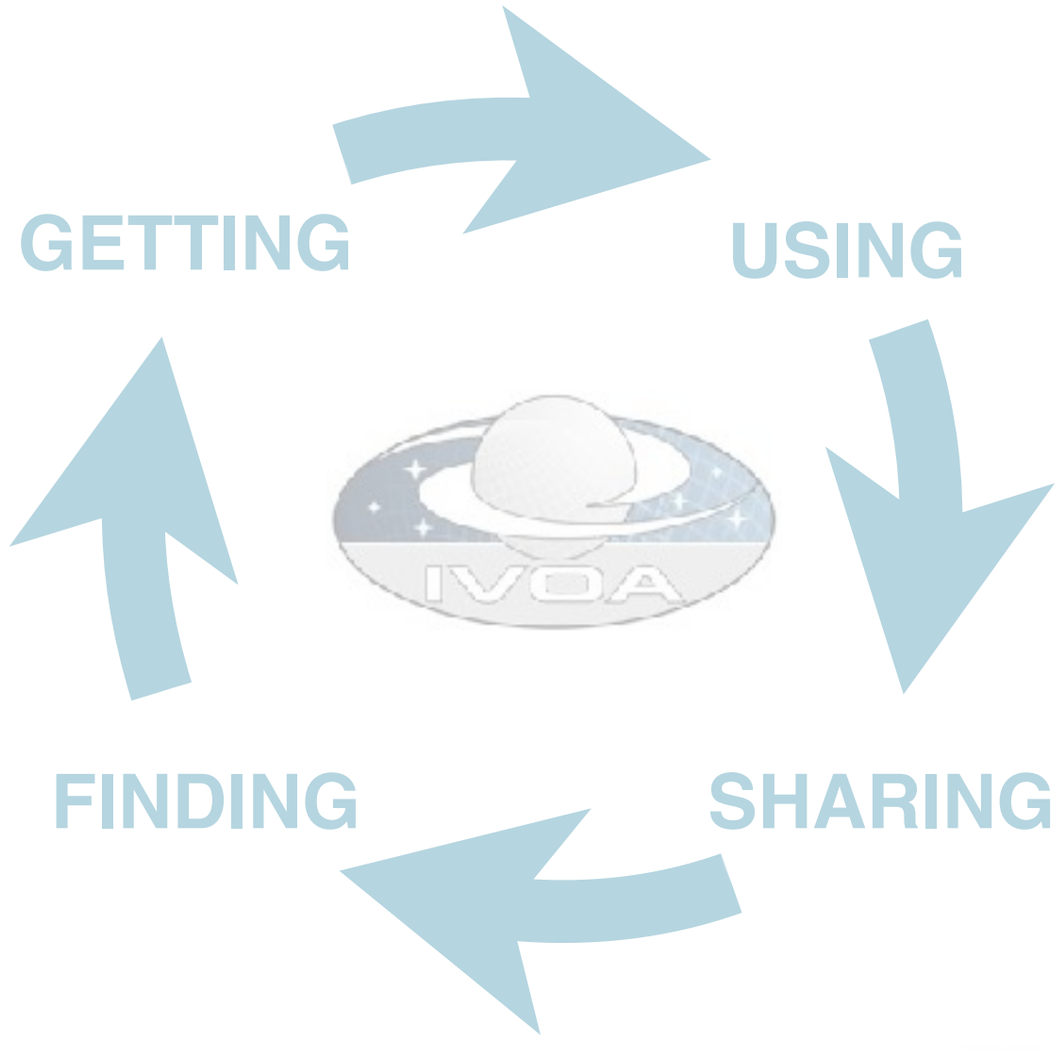
"A multi-wavelength digital sky that can be searched, visualised and analysed in new and innovative ways"

What is the Virtual Observatory?

- Framework for astronomical datasets, tools, services to work together in a seamless way

What is the International Virtual Observatory Alliance?

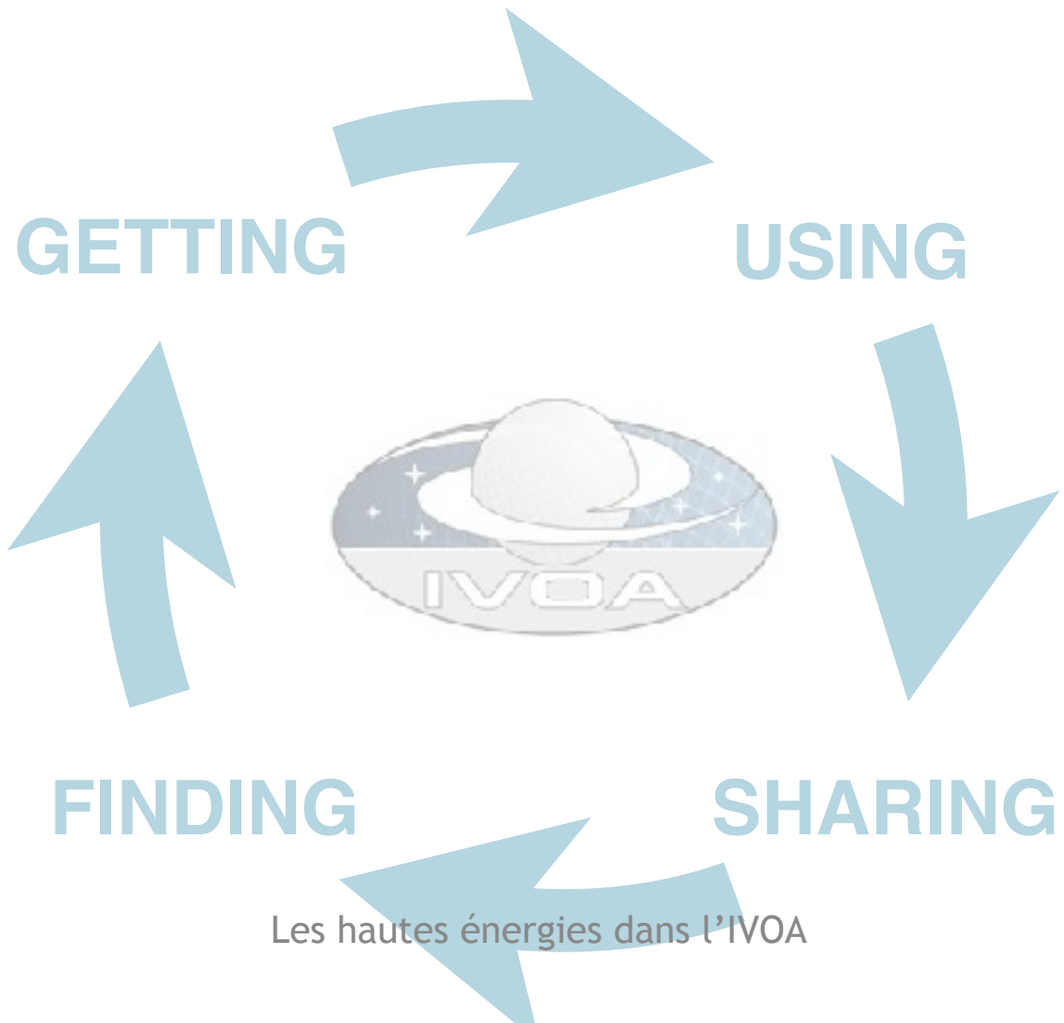
- A science driven organisation that builds the technical standards
- A place for discussing and sharing VO ideas and technology to enable science
- Promoting and publicising the VO



The VO and the IVOA: why?

Clear benefits

- Growth in the scientific return of data
- Capability to discover and fuse multiple data sets
- Application of the VO in planning new observations and observing strategies



The VO and the IVOA: who?

Who is the IVOA? **http://ivoa.net/**

- Exec, Tech Coordination, Standards & processes, Media, Science priorities
- **6 Working Groups:**
  - Applications, access, models, grid & web services, registry, semantics
- **8 Interest Groups**
  - Time-domain, radio, solar system, education, data curation, knowledge & discovery, theory
- Completely open to participation

Want to join the IVOA?

- Meetings: 2 interoperability meetings per year
- Email list: https://www.ivoa.net/members/index.html
- GitHub: https://github.com/ivoa-std)

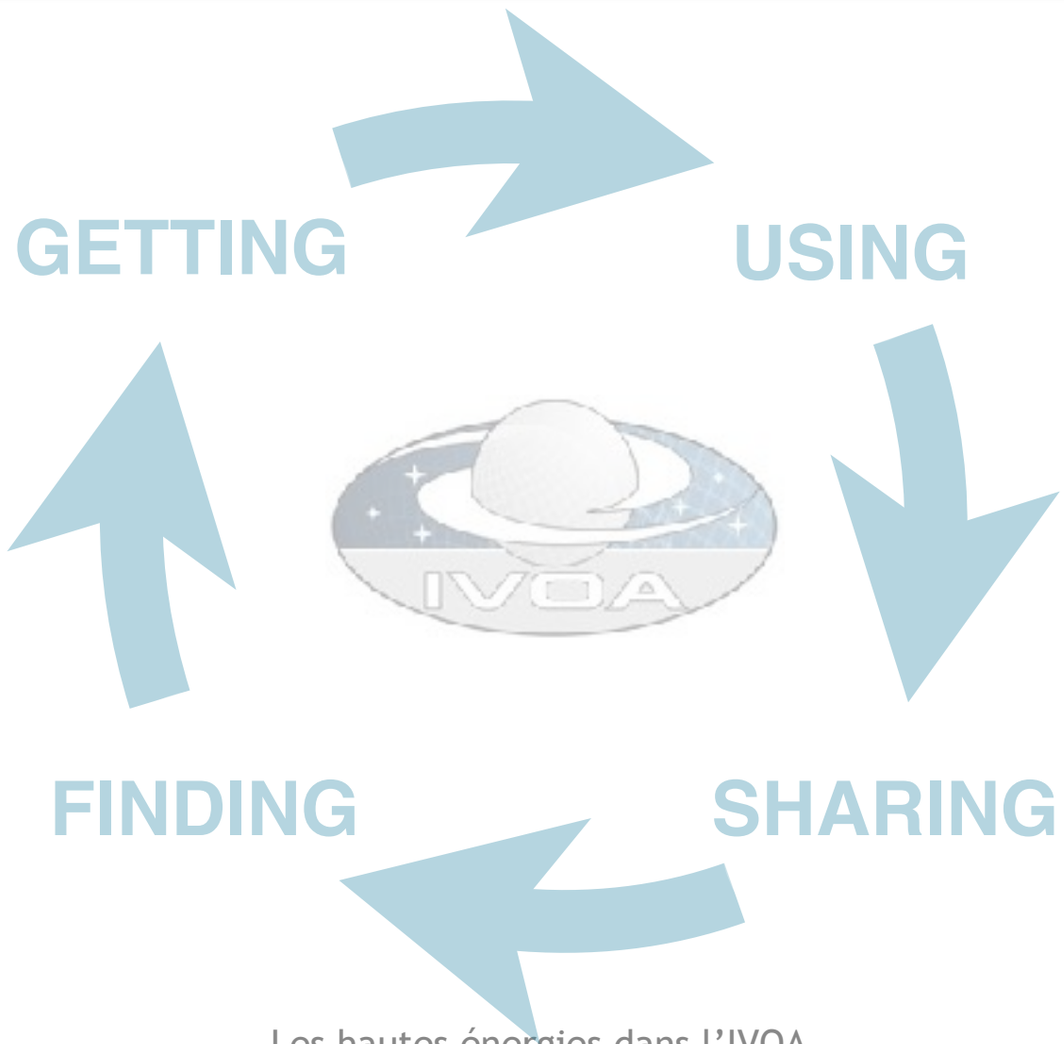
ada.nebot@astro.unistra.fr

The VO and the IVOA: where?

Existing global framework: populated by major data providers (space and ground based) that is heavily used by the community (e.g. Gaia data access is fully VO)

The VO and the IVOA: how?

Through the development and adoption of common standards scientifically driven, as an international community effort where astronomers, software engineers and documentalists are involved



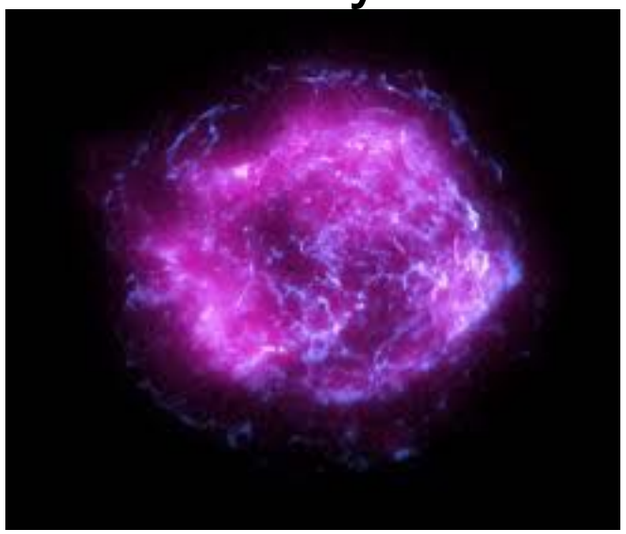
IVOA development process of standards

- Build IVOA standards to match users needs:
  - Find and report the community needs
  - Find and report gaps in the existing standards
  - Propose new ways to fill the gaps
  - Implement & validate
  - Standardise when consensus is reached

Les Hautes Energies

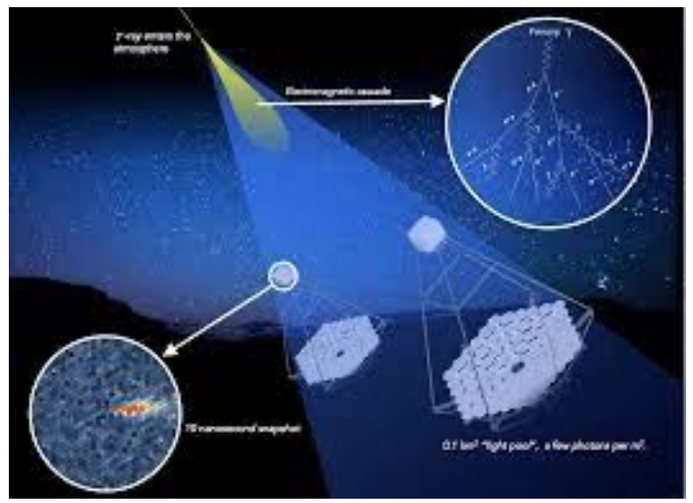
What is high energy astronomy?

- What is high energy astronomy? X-ray - gamma-ray - extreme UV - neutrinos - cosmic rays -
  - X-ray

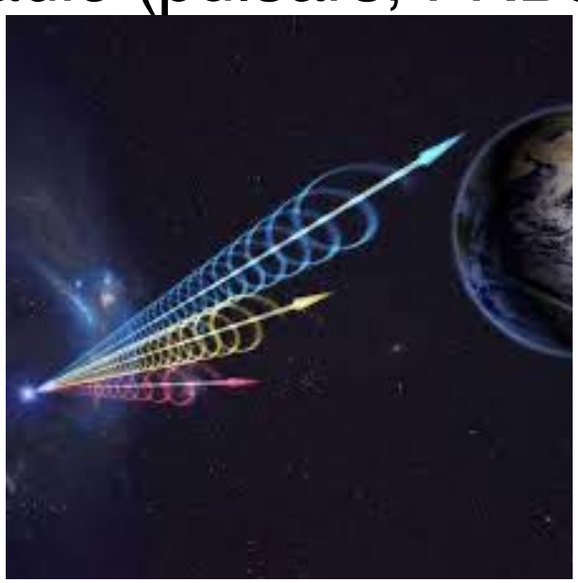


  - gamma-ray

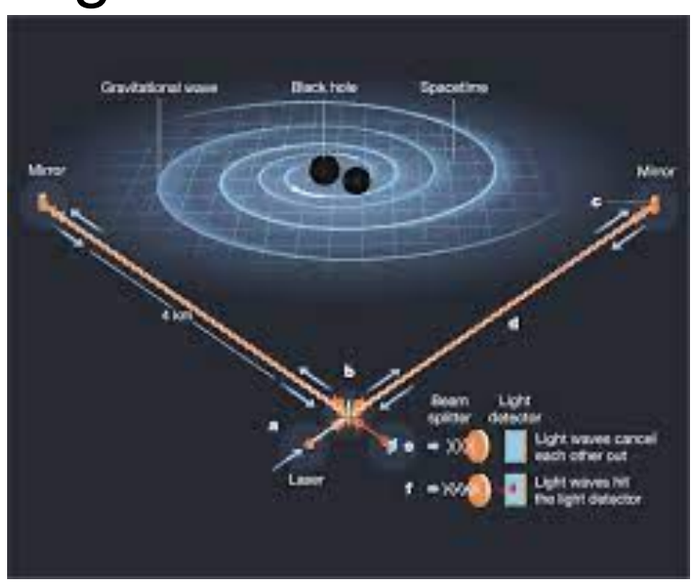
  - cosmic rays



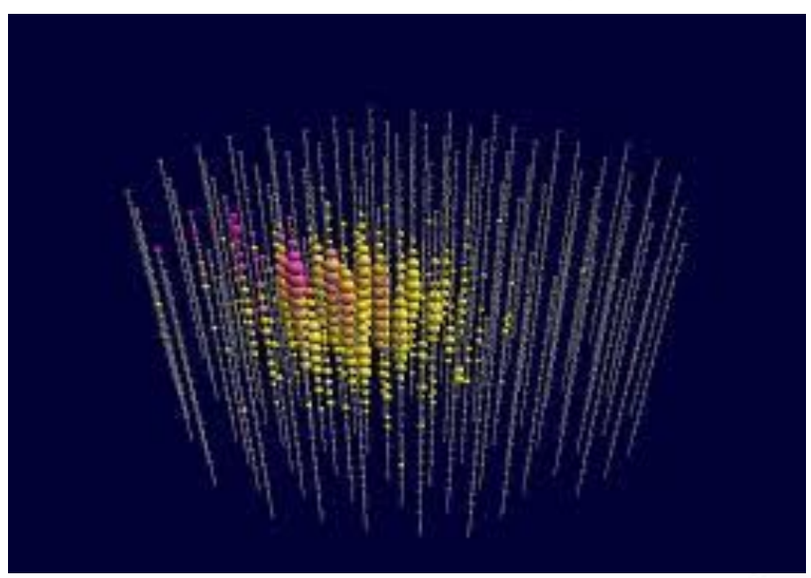
- radio (pulsars, FRBs)



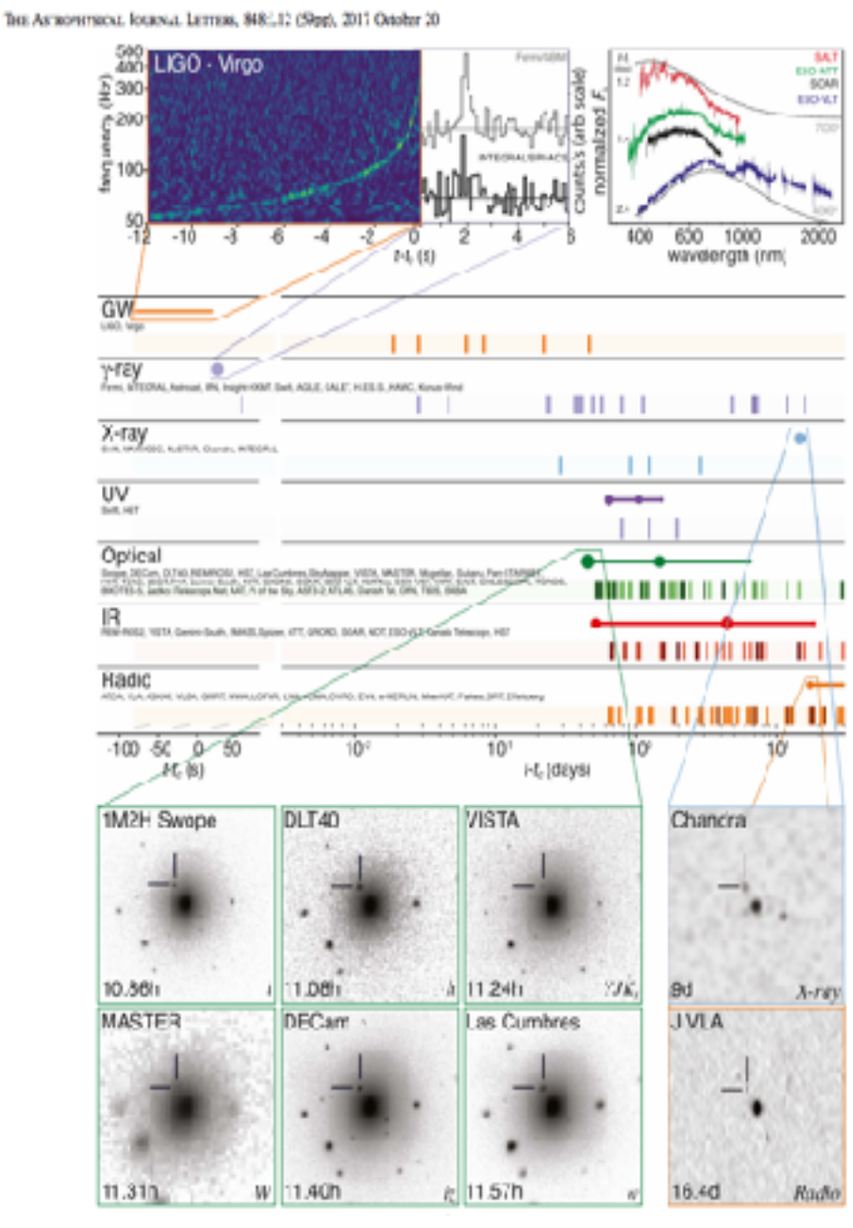
- gravitational waves

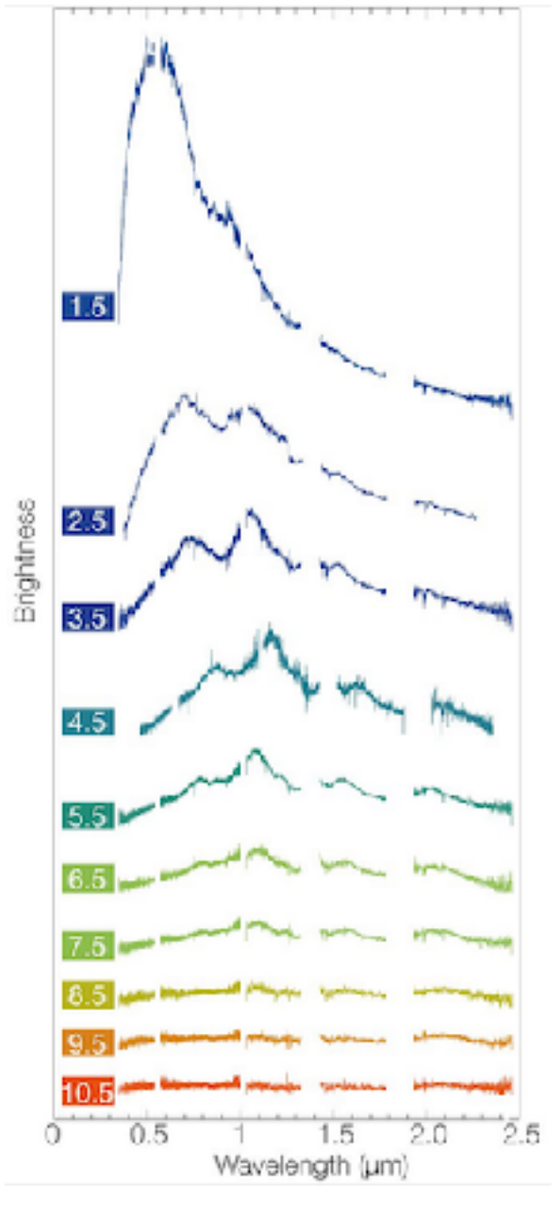


- neutrinos



Les hautes energies





- Multi-wavelength / messenger approach is needed - different data types
- Follow-up observations and reaction time for that can be crucial - alerts
- Analysis, Visualisation & navigation through the data
- Coordination & transmission of information

The IVOA should match user's needs

Quelles sont les (quelques sélectionnés) standards IVOA pour les hautes energies?

1. **VOTable** a format for tabular data for allowing interoperability (coosys, timesys, ucd, utype, VOunits, datalink).
2. Search for data:
   - **Cone search** — spatial + temporal interval search
   - **MOC** — spatial and temporal indexing for large data volumes and complex areas
   - **ObsCore & ObsTAP** — description of observations (**ADQL**)
3. Planning of observations:
   - **ObjVisSAP** — visibility of object to plan observations
   - **ObsLocTAP** — facilitate coordination of observations
   - Facilities / observatory list
4. Transmission of alerts: **VOEvents & VOEvent Transport protocol**
5. Description of provenance **ProvenanceDM & ProvTAP**
6. Registering the services — **RM - Resource Metadata for the Virtual Observatory**
7. Communication : **Send / receive (share) data among services & tools with SAMP**

VOTable time medatada

Standardisation of coordinate system annotation (time and coordinates)

Time Scale: UTC, TT, TAI, TCB,…

Format: JD, MJD, ISO, truncated ISO,…

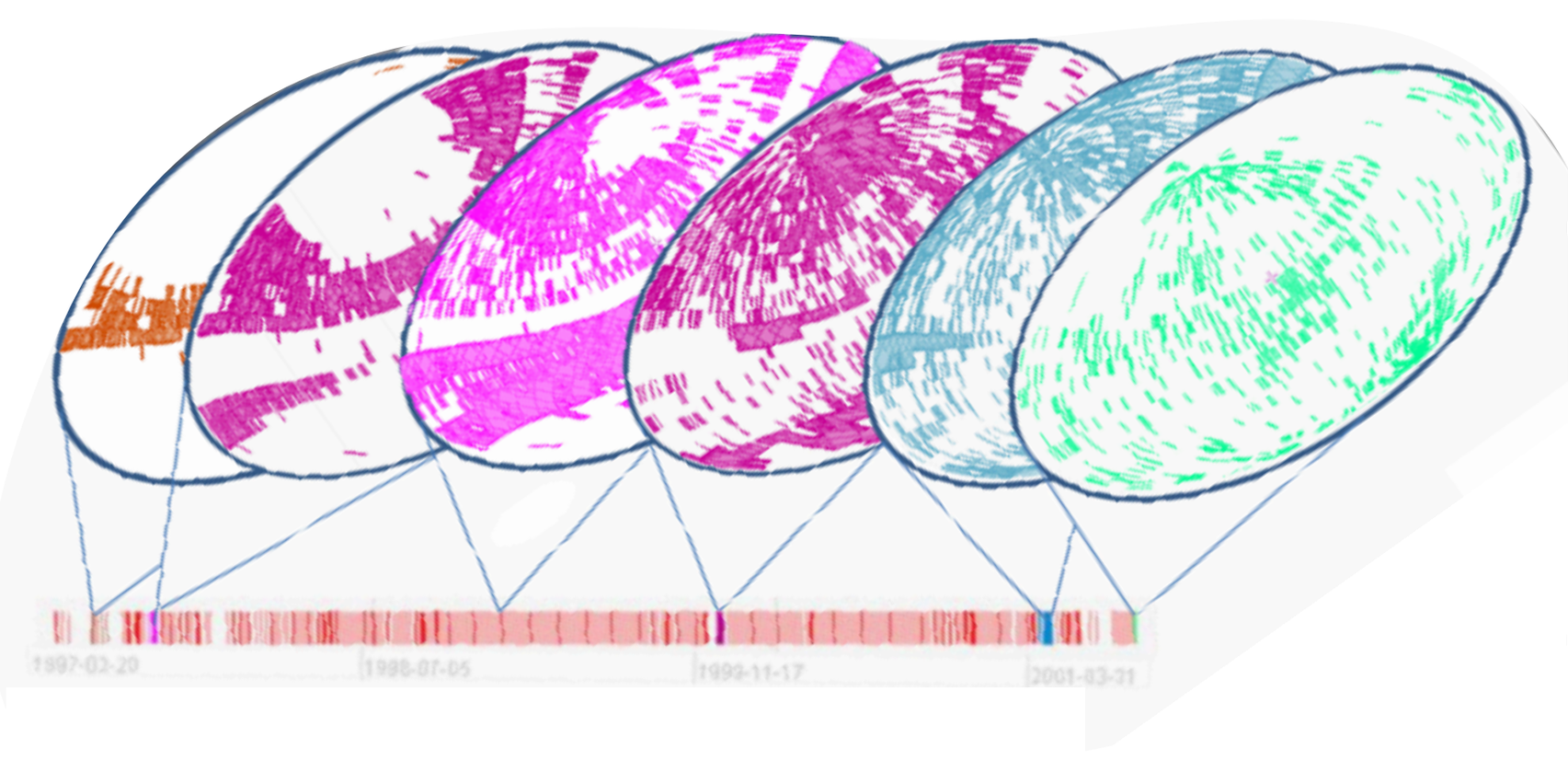
Offset: e.g. JD-XXX (e.g. Gaia…)

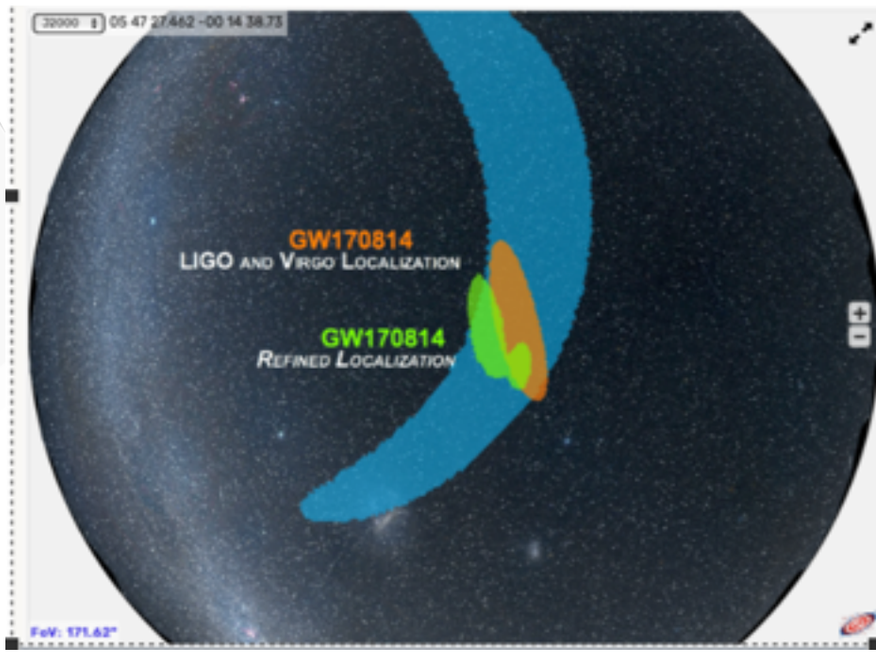
Reference position: Topocentre, Geocentre, Barycentre,… (light-travel correction)

UCD, VOUnits, datalink

Search: know where & when

- Cone search extension to add a time interval for search in cats.
- Search by temporal+spatial coverage of surveys for the more complicated areas (ST-MOC = space-time multi-order coverage map)





International Virtual Observatory Alliance

MOC: Multi-Order Coverage map

Version 2.0

IVOA Recommendation 2022-03-17

Working group
: Applications

This version
: http://www.ivoa.net/documents/moc/20220317

Latest version
: http://www.ivoa.net/documents/moc

Previous versions
: Version1.1
: Version1.0

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International Virtual Observatory Alliance

Simple Cone Search

Version 1.1

IVOA Working Draft 2020-08-28

Working group
: Data Access Layer

This version
: http://www.ivoa.net/documents/ConeSearch/20200828

Latest version
: http://www.ivoa.net/documents/ConeSearch

Previous versions
: REC 1.03
: PR 2007-09-14
: PR 2007-06-28
: PR 2006-09-08

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Editor(s)
: Marco Molinaro, Ada Nebot, Raymond Plante

ObsCore & ObsTAP

- **Goal: “ we need to give data providers a set of metadata attributes that they can easily map to their database system in order to support queries of the sort listed below.”**

- Science cases:
  - Support multi-wavelength as well as positional and temporal searches.
  - Support any type of science data product (**image, cube, spectrum, time series, instrumental data, etc.**).
  - Directly support the sorts of file content typically found in archives (FITS, VOTable, compressed files, instrumental data, etc.).

ObsCore & ObsTAP are Key IVOA standards for searching, finding and combining all sorts of data and allow for interoperability

ObsCore & ObsTAP

International Virtual Observatory Alliance

Observation Data Model Core Components and its Implementation in the Table Access Protocol

Version 1.1

IVOA Recommendation, May 09, 2017

Approved by IVOA executive committee March 20, 2017

Working Groups: Data Model, Data Access Layer

This version:

http://www.ivoa.net/Documents/ObsCore/20170509/REC-ObsCore-v1.1-20170509.pdf

Latest version:

http://www.ivoa.net/Documents/ObsCore/20170509/REC-ObsCore-v1.1-20170509.pdf

Previous version(s):

http://www.ivoa.net/Documents/ObsCore/20161004/PR-ObsCore-v1.1-20161004.pdf

Editors:

Mireille Louys, Doug Tody, Patrick Dowler, Daniel Durand

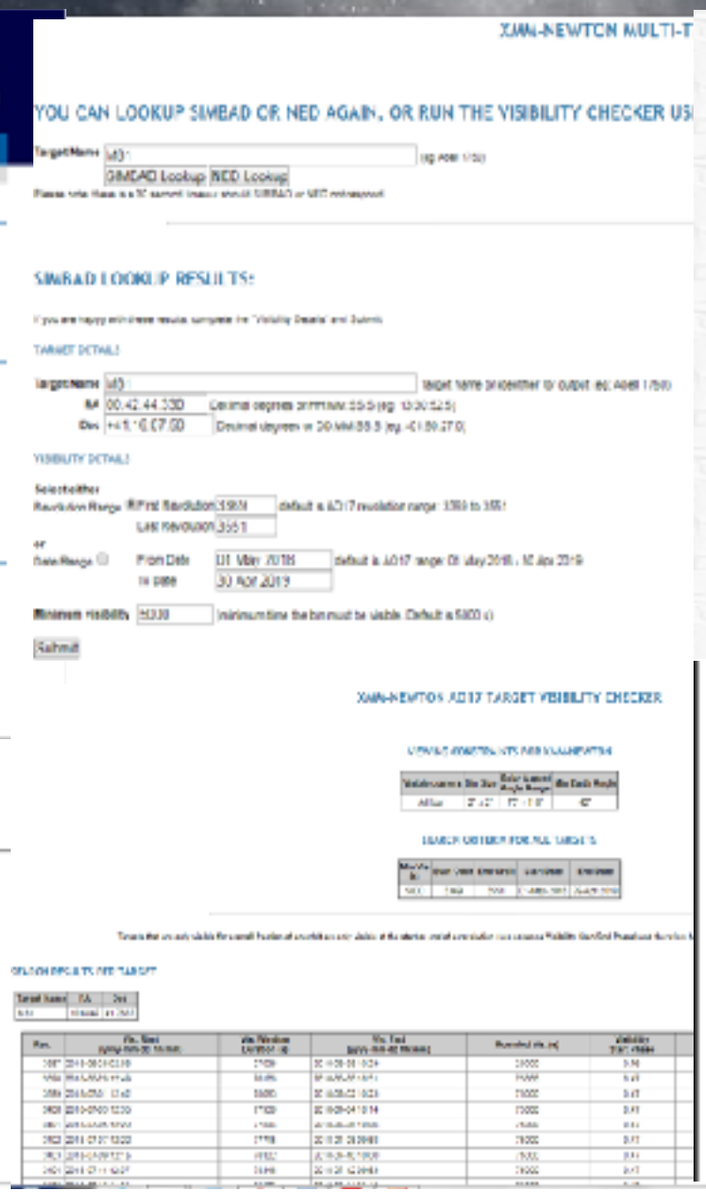
Authors:

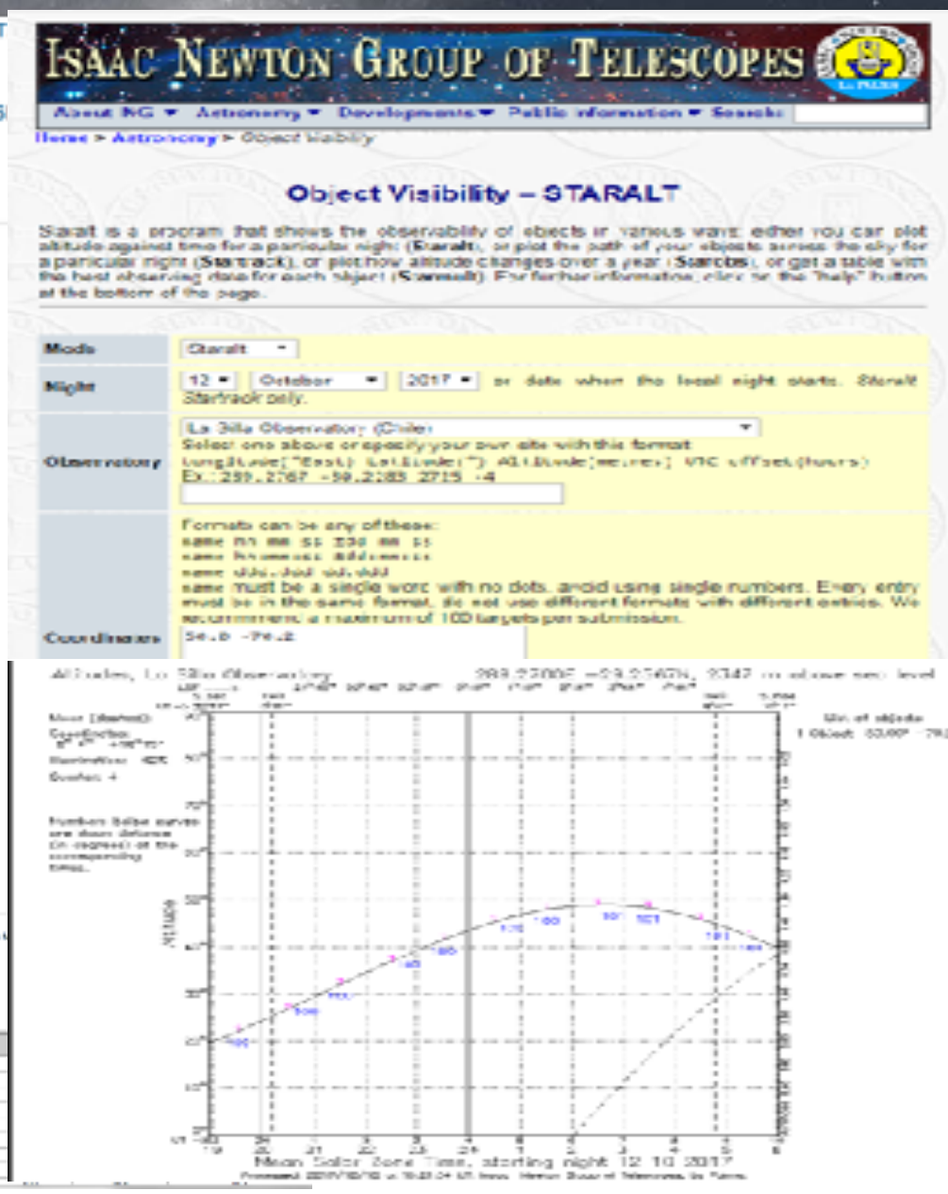
Mireille Louys, Doug Tody, Patrick Dowler, Daniel Durand, Laurent Michel, Francois Bonnarel, Alberto Micol and the IVOA DataModel working group

- Map the METADATA of your project data into ObsCore Keywords
- Set a TAP Service
- Register it

➡ Search, find, and combine the data coming from multiple missions

Visibility of an object



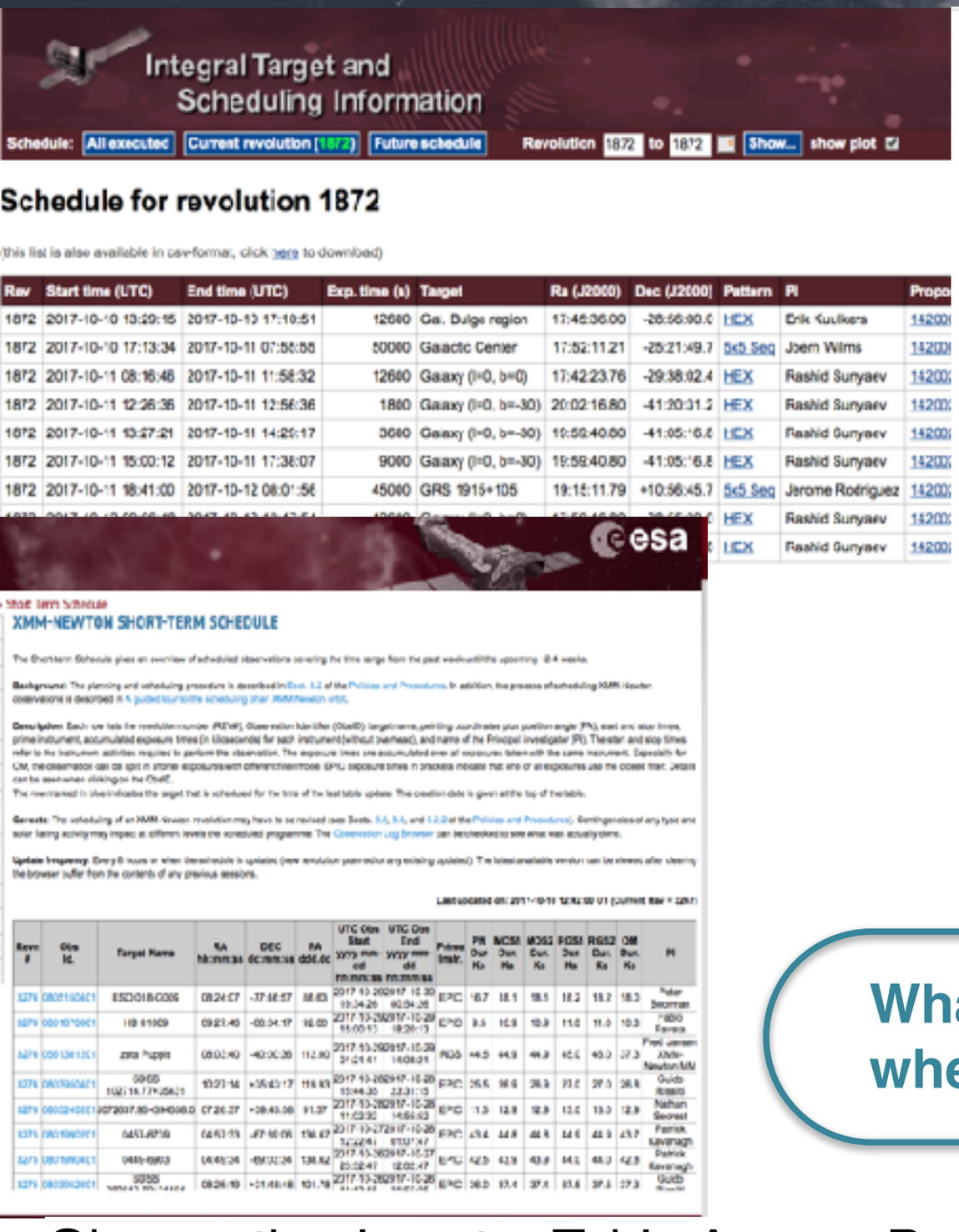


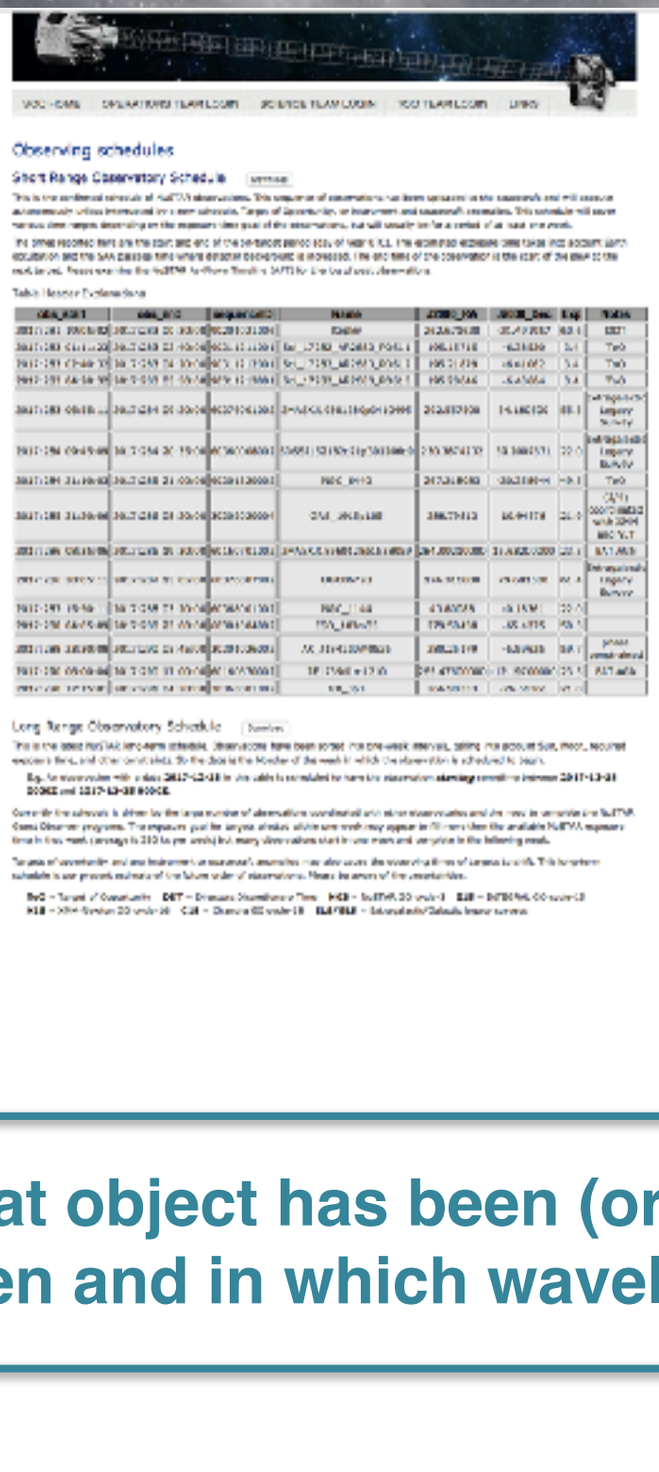
Different services have different inputs / outputs

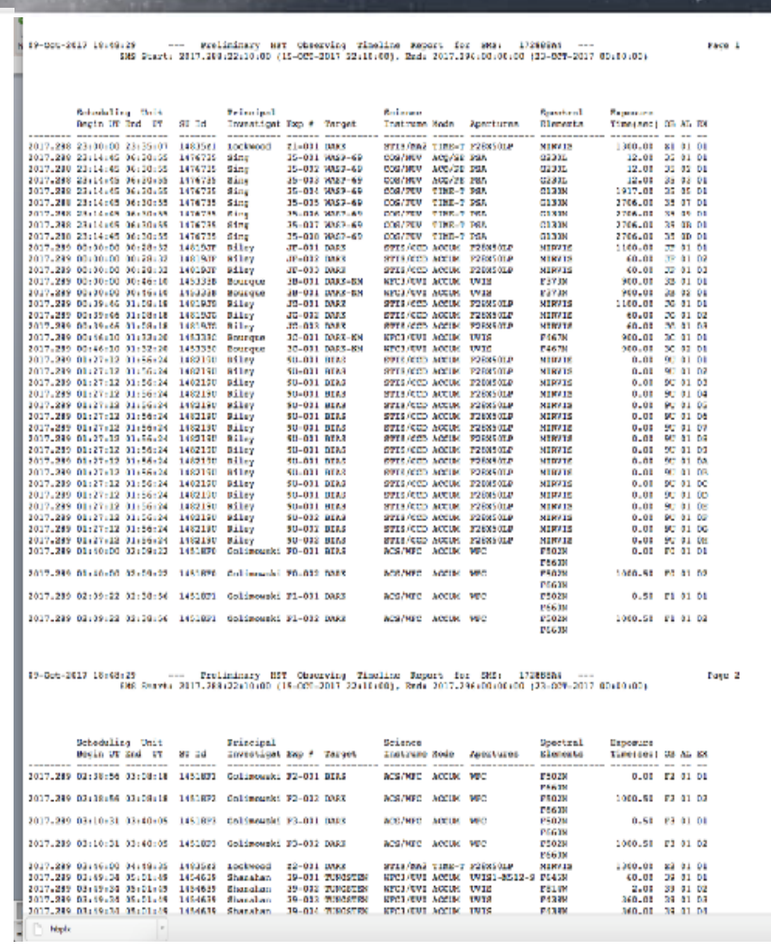
Facilitate the work by having some level of standardisation inputs / outputs

Object Visibility Simple Access Protocol, Aitor Ibarra, Richard Saxton, Jesús Salgado et al. 2019
http://www.ivoa.net/documents/ObjVisSAP/index.html

Coordination of observations







What object has been (or will be) observed when and in which wavelength?

Observation Locator Table Access Protocol, Aitor Ibarra, Jesús Salgado et al. 2019
http://www.ivoa.net/documents/ObsLocTAP/

International Virtual Observatory Alliance

Observation Locator Table Access Protocol

Version 0.5

IVOA Working Draft 09 September 2019

This version:
http://www.ivoa.net/documents/ObsLocTAP/20190909/
Latest version:
http://www.ivoa.net/documents/ObsLocTAP/
Previous version(s):
http://www.ivoa.net/documents/ObsLocTAP/20180723/

Working Group:
http://www.ivoa.net/twiki/bin/view/IVOA/IvoaDAL

Editor(s):
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TBC: Representatives of a large multi-observatory collaboration

International Virtual Observatory Alliance

Object Visibility Simple Access Protocol

Version 0.5

IVOA Working Draft 19 March 2019

This version:
ObjVisSAP-0.5-20190319
Latest version:
ObjVisSAP-0.4-20180912

Previous version(s):

Working Group:
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Author(s):
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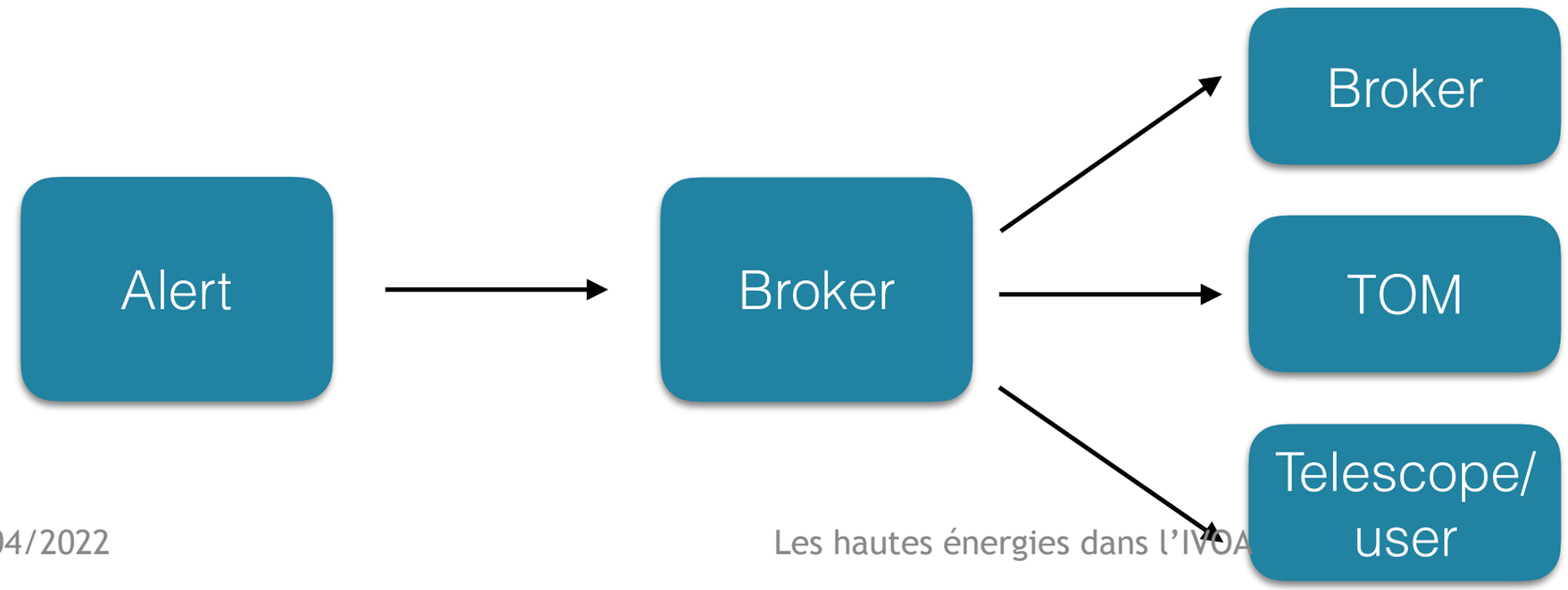
TBC: Representatives of a large multi-observatory collaboration

Alerts

1. VOEvent (REC):
    1. Container —> XML
    2. Content —> defined by the community: FRB, (GRB, SN, Neutrino,…)
2. VOEvent Transport protocol (REC):
    1. Works for low rates (10 Hz)
    2. Doesn’t scale for very high rates (10^3Hz)
3. Open questions:
    1. A VOEvents validation library is missing
    2. How to find who distributes alerts? Register in the registry?



Provenance

International Virtual Observatory Alliance

IVOA Documents

IVOA Provenance Data Model
Version 1.0

IVOA Recommendation 11 April 2020

Interest/Working Group:
http://www.ivoa.net/twiki/bin/view/IVOA/IvoaDataModel
Author(s):
Mathieu Servillat, Kristin Riebe, Catherine Boisson, François Bonnarel, Anastasia Galkin, Mireille Louys, Markus Nullmeier, Nicolas Renault-Tinacci, Michèle Sanguillon, Ole Streicher
Editor(s):
Mathieu Servillat

Abstract

This document describes how provenance information can be modeled, stored and exchanged within the astronomical community in a standardized way. We follow the definition of provenance as proposed by the W3C, i.e. that "provenance is information about entities, activities, and people involved in producing a piece of data or thing, which can be used to form assessments about its quality, reliability or trustworthiness." Such provenance information in astronomy is important to enable any scientist to trace back the origin of a dataset (e.g. an image, spectrum, catalog or single points in a spectral energy distribution diagram or a light curve), a document (e.g. an article, a technical note) or a device (e.g. a camera, a telescope), learn about the people and organizations involved in a project and assess the reliability, quality as well as the usefulness of the dataset, document or device for her own scientific work.

Status of this document

This document has been produced by the Data Model Working Group.
It has been reviewed by IVOA Members and other interested parties, and has been endorsed by the IVOA Executive Committee as an IVOA Recommendation. It is a stable document and may be used as reference material or cited as a normative reference from another document. IVOA's role in making the Recommendation is to draw attention to the specification and to promote its widespread deployment. This enhances the functionality and interoperability inside the Astronomical Community.

Available formats: pdf, tex

maintained by ::ivoa document coordinator::

Register your services

IVOA Recommendation

International Virtual Observatory Alliance

IVOA Documents

Resource Metadata for the Virtual Observatory
Version 1.12

IVOA Recommendation 02 March 2007

Interest/Working Group:
http://www.ivoa.net/twiki/bin/view/IVOA/IvoaRegReg
Author(s):
Robert Hanisch, the IVOA Resource Registry Working Group, the NVO Metadata Working Group
Editor(s):
Robert Hanisch
DOI:
10.5479/ADS/bib/2007ivoa.spec.0302H

Abstract

An essential capability of the Virtual Observatory is a means for describing what data and computational facilities are available where, and once identified, how to use them. The data themselves have associated metadata (e.g., FITS keywords), and similarly we require metadata about data collections and data services so that VO users can easily find information of interest. Furthermore, such metadata are needed in order to manage distributed queries efficiently; if a user is interested in finding x-ray images there is no point in querying the HST archive, for example. In this document we suggest an architecture for resource and service metadata and describe the relationship of this architecture to emerging Web Services standards. We also define an initial set of metadata concepts.

Status of this document

This document has been produced by the Resource Registry Working Group.
It has been reviewed by IVOA Members and other interested parties, and has been endorsed by the IVOA Executive Committee as an IVOA Recommendation. It is a stable document and may be used as reference material or cited as a normative reference from another document. IVOA's role in making the Recommendation is to draw attention to the specification and to promote its widespread deployment. This enhances the functionality and interoperability inside the Astronomical Community.

.html .doc .pdf

SAMP

International Virtual Observatory Alliance

IVOA Documents

Simple Application Messaging Protocol
Version 1.3

IVOA Recommendation 11 April 2012

Interest/Working Group:
http://www.ivoa.net/twiki/bin/view/IVOA/IvoaApplications
Author(s):
M. Taylor, T. Boch, M. Fitzpatrick, A. Allan, J. Fay, L. Paioro, J. Taylor, D. Tody
Editor(s):
T. Boch, M. Fitzpatrick, M. Taylor
DOI:
10.5479/ADS/bib/2012ivoa.spec.1104T

Errata

No errata yet

Abstract

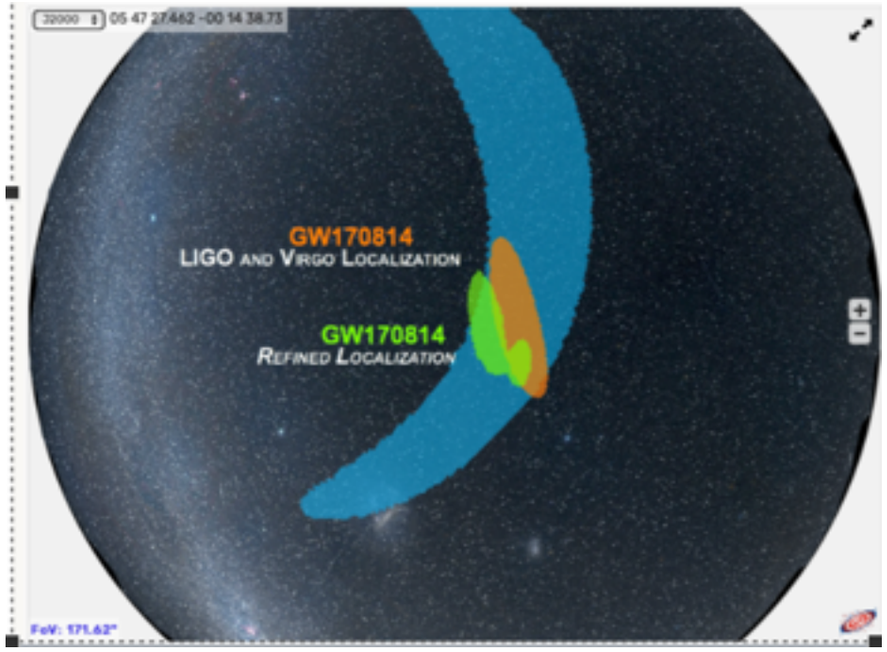
SAMP is a messaging protocol that enables astronomy software tools to interoperate and communicate. IVOA members have recognised that building a monolithic tool that attempts to fulfil all the requirements of all users is impractical, and it is a better use of our limited resources to enable individual tools to work together better. One element of this is defining common file formats for the exchange of data between different applications. Another important component is a messaging system that enables the applications to share data and take advantage of each other's functionality. SAMP supports communication between applications on the desktop and in web browsers, and is also intended to form a framework for more general messaging requirements.

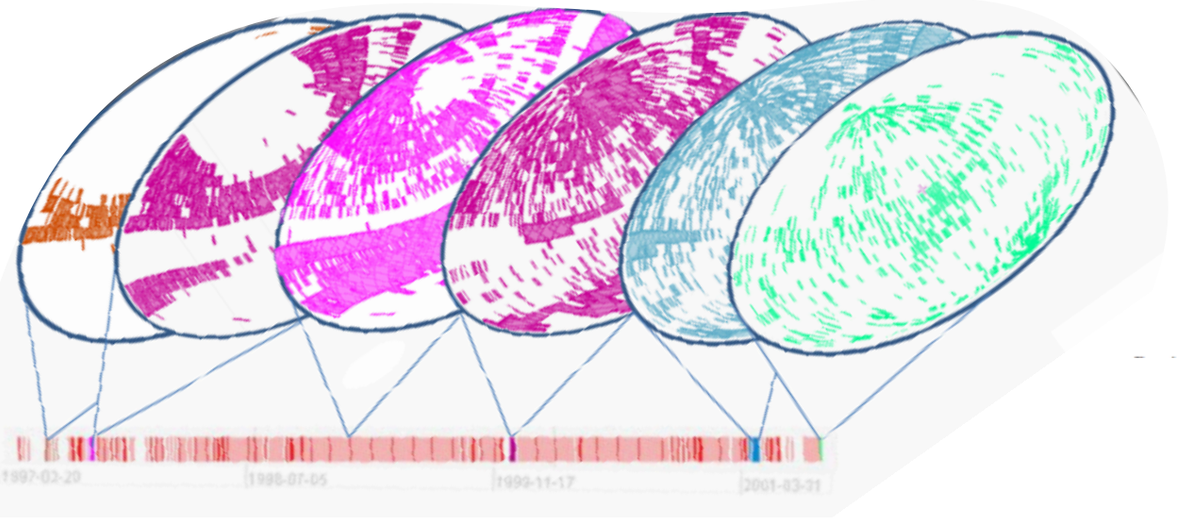
Status of this document

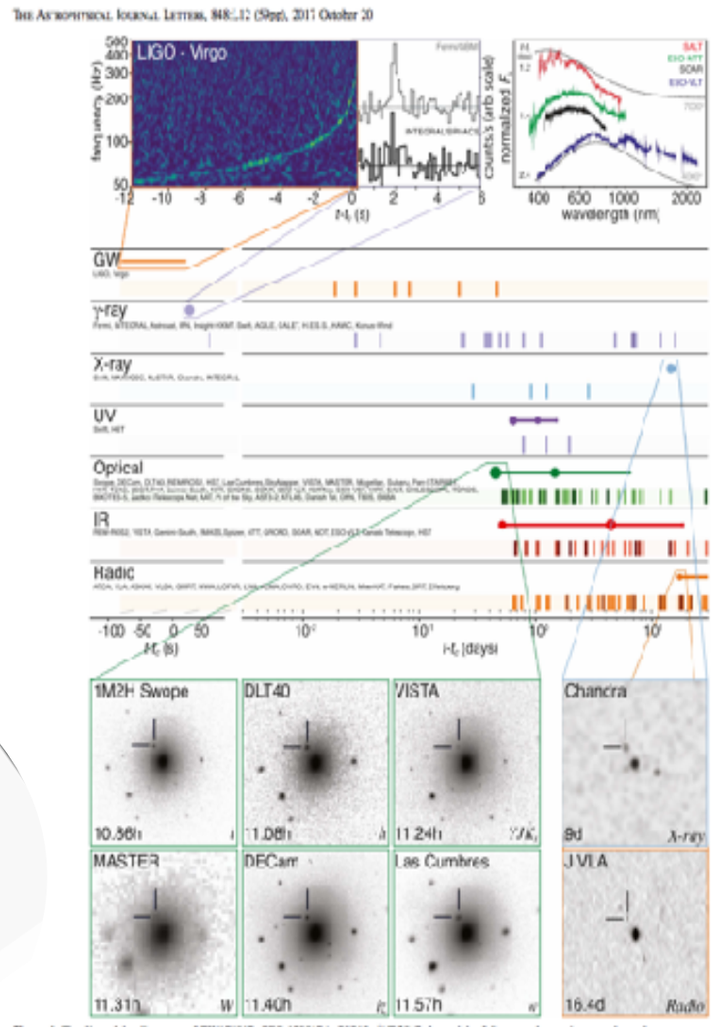
This document has been produced by the Applications Interest Group.
It has been reviewed by IVOA Members and other interested parties, and has been endorsed by the IVOA Executive Committee as an IVOA Recommendation. It is a stable document and may be used as reference material or cited as a normative reference from another document. IVOA's role in making the Recommendation is to draw attention to the specification and to promote its widespread deployment. This enhances the functionality and interoperability inside the Astronomical Community.

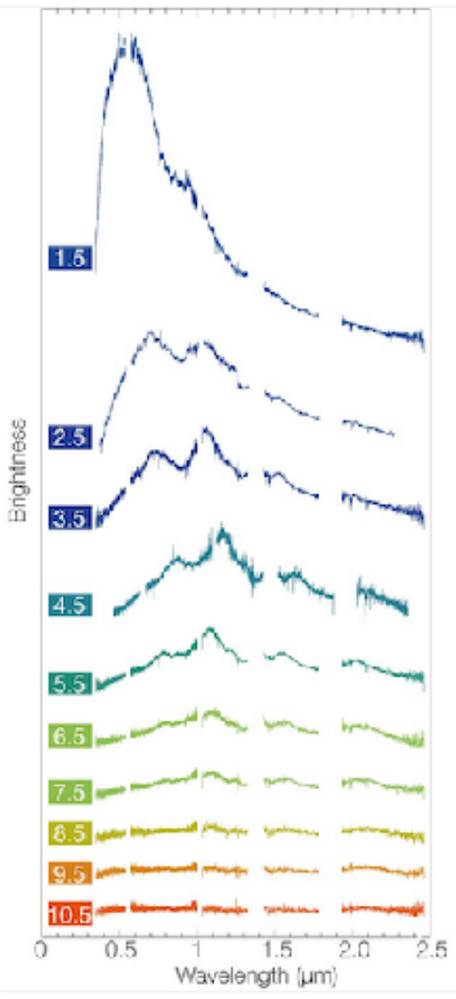
Available formats: PDF, HTML

In a multi-messenger landscape









Publishing your data in the VO

- https://wiki.ivoa.net/twiki/bin/view/IVOA/PublishingInTheVO

What next?

- Roadmap
  1. State of the art for High Energy Astronomy:
     - archives
     - tools
     - mission data distribution plans
  2. Evaluate if the existing standards are enough or if we need changes / new developments?
  3. Collect the scientific use cases and set the minimal requirements

- **The IVOA needs the community to participate!**

Summary

- The IVOA standards are built to enable access, discovery and ultimately **interoperability**
- The IVOA standards needed for High Energy Astronomy are existing or under development
- **The IVOA needs the community to participate!**

Seance ASOV Hautes energies

- Catherine Boisson - CTA
- Laurent Michel - XMM-Newton
- Eric Chassande-Mottin - LIGO/Virgo
- Fabian Schussler - AstroColibri
- Fabio Acero - Athena

Quelques liens

- ivoa.net
- IVOA Docs : https://www.ivoa.net/documents/
- IVOA GitHub : https://github.com/ivoa
- IVOA mailing list : https://www.ivoa.net/members/index.html