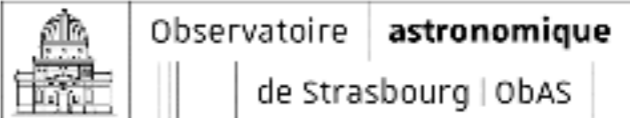




Les hautes énergies à l'IVOA

Journées ASOV 2022

Ada Nebot



□ 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?

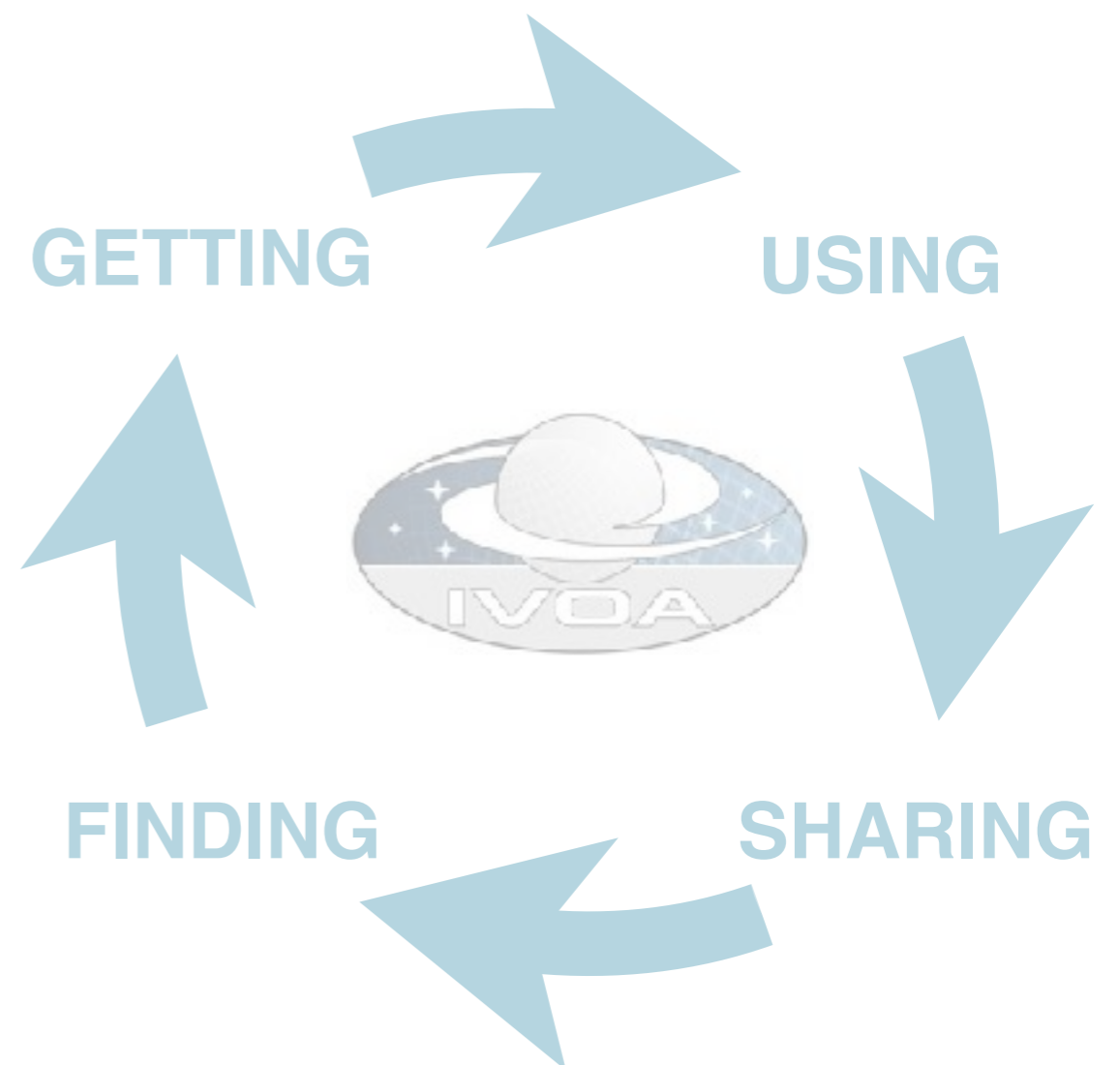
“A multi-wavelength digital sky that can be searched, visualised and analysed in new and innovative ways”

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?

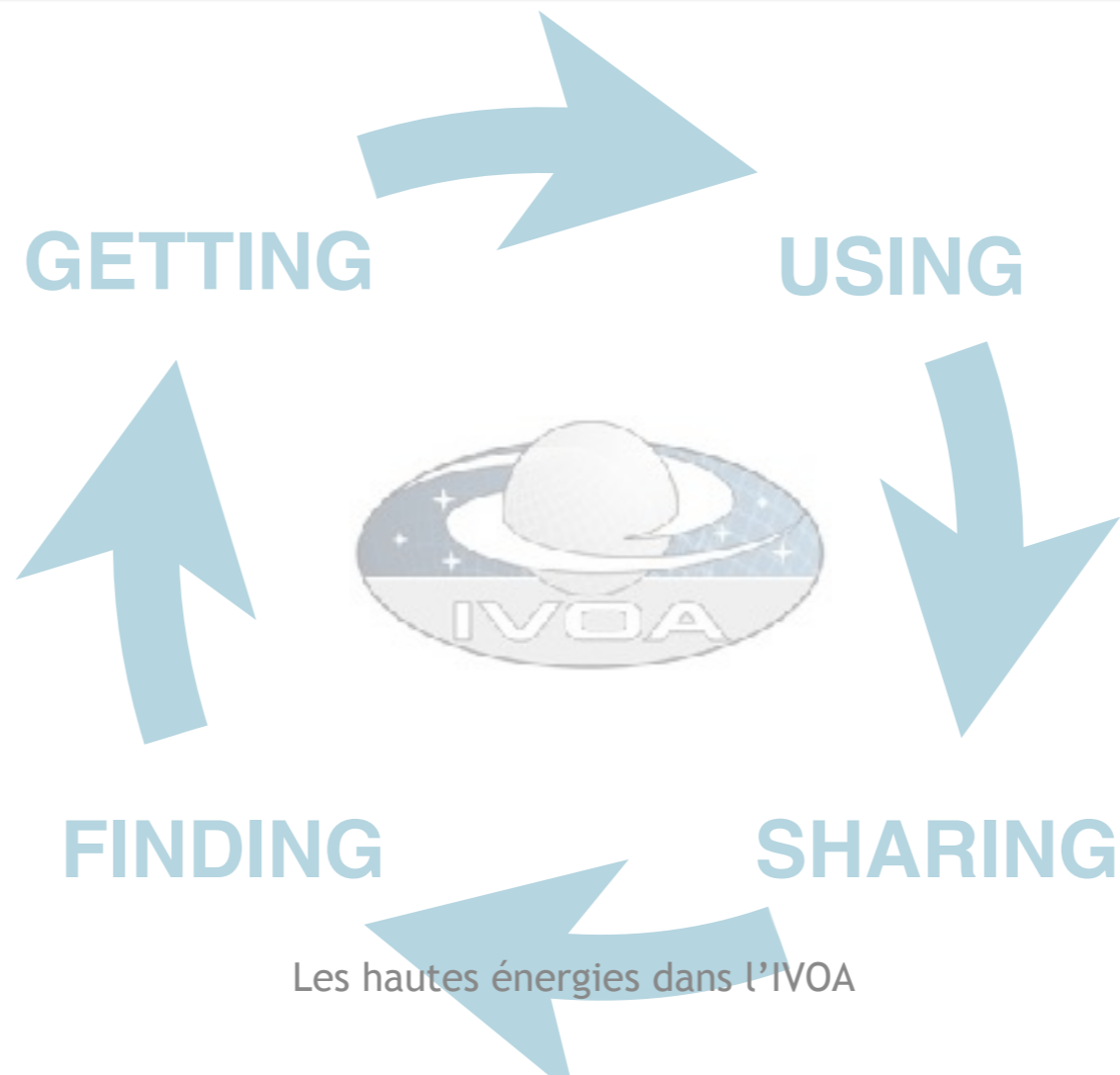
- A science driven organisation that builds the technical standards
- A place for discussing and sharing VO ideas and technology to enable science
- Promoting and publicising the VO



□ 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

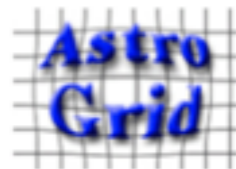
Want to join the IVOA?

- 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)



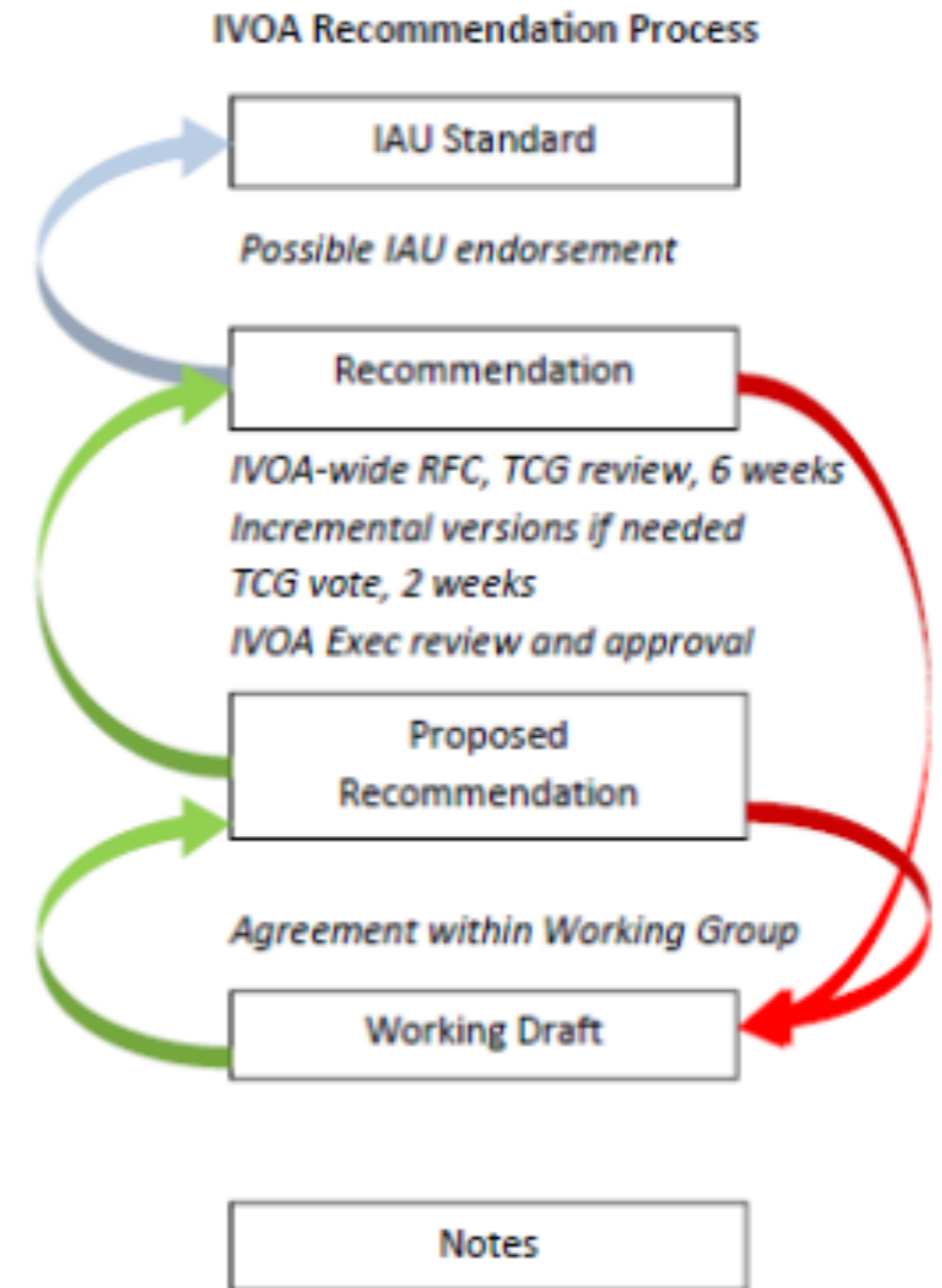
□ The VO and the IVOA: how?

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 -

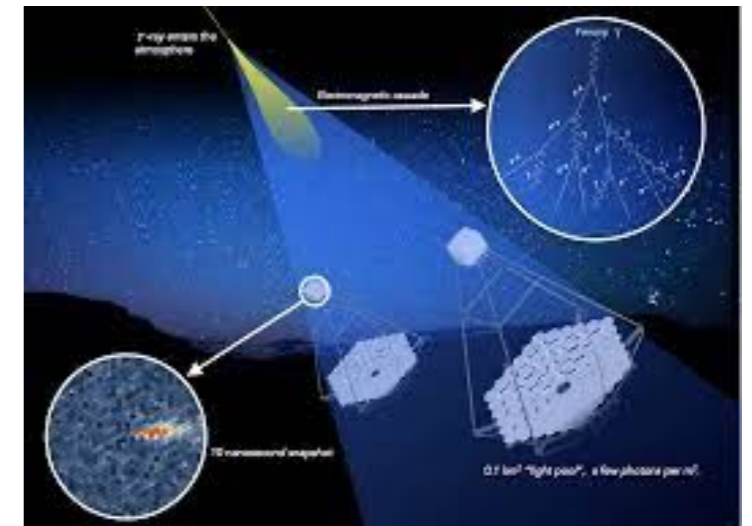
- X-ray



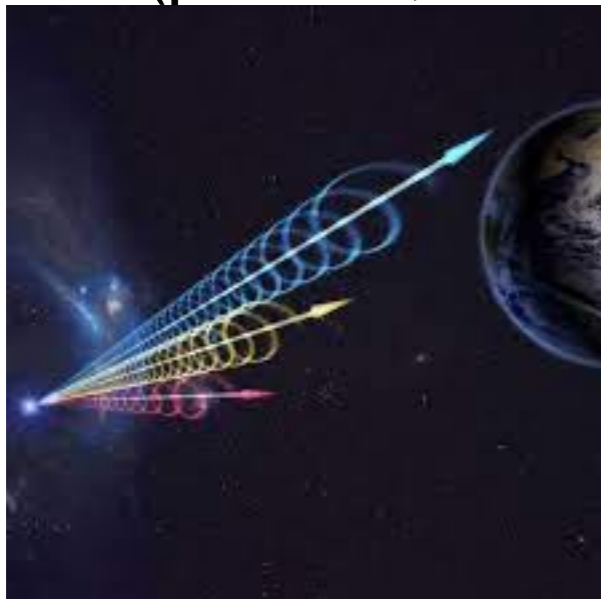
- gamma-ray



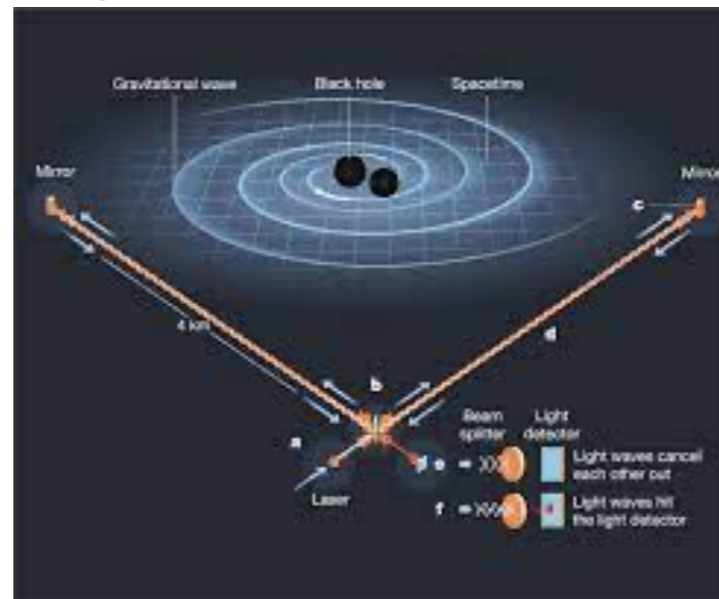
- cosmic rays



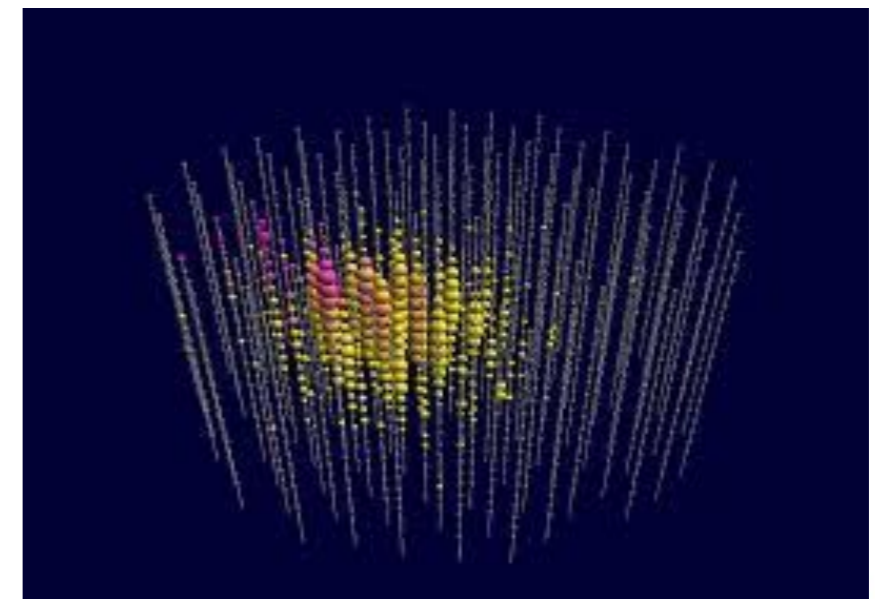
- radio (pulsars, FRBs)



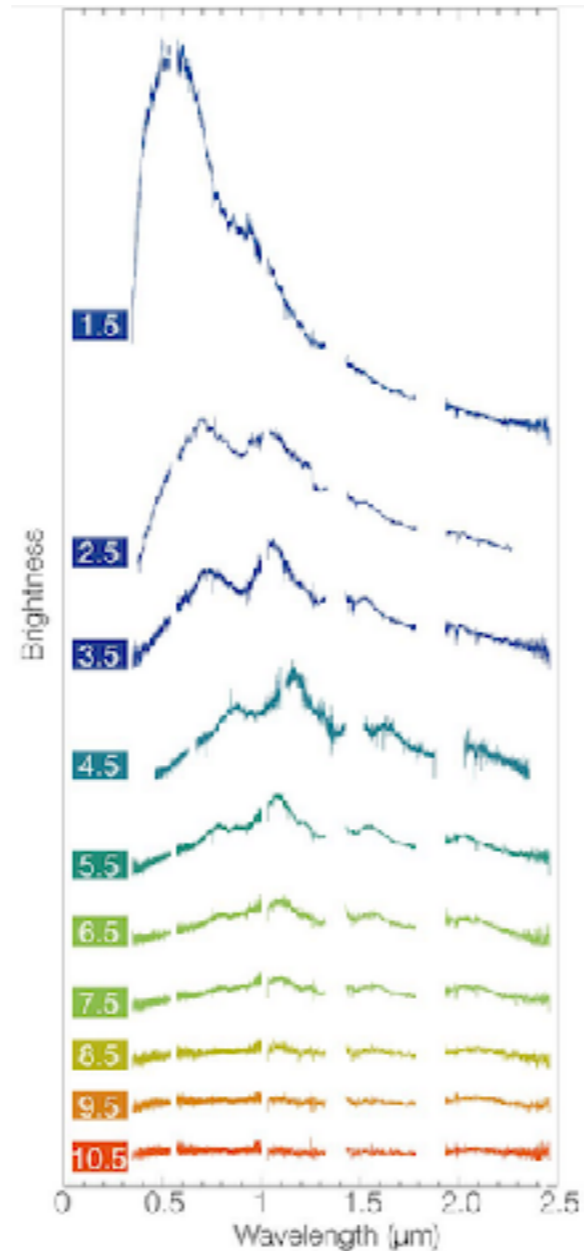
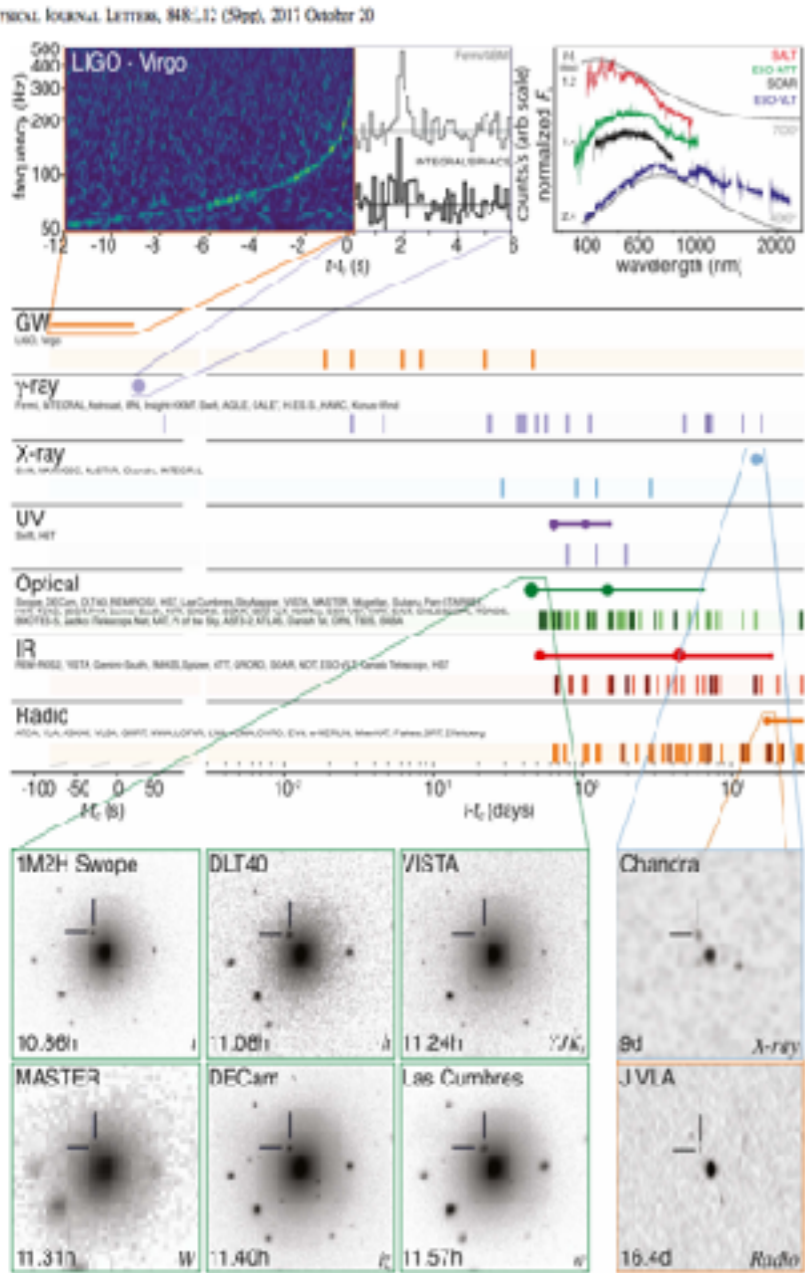
- gravitational waves



- 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 énergies?

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 metadata

Standardisation of coordinate system annotation (time and coordinates)

Time Scale: UTC, TT, TAI, TCB,...

Format: JD, MJD, ISO, truncated ISO,...

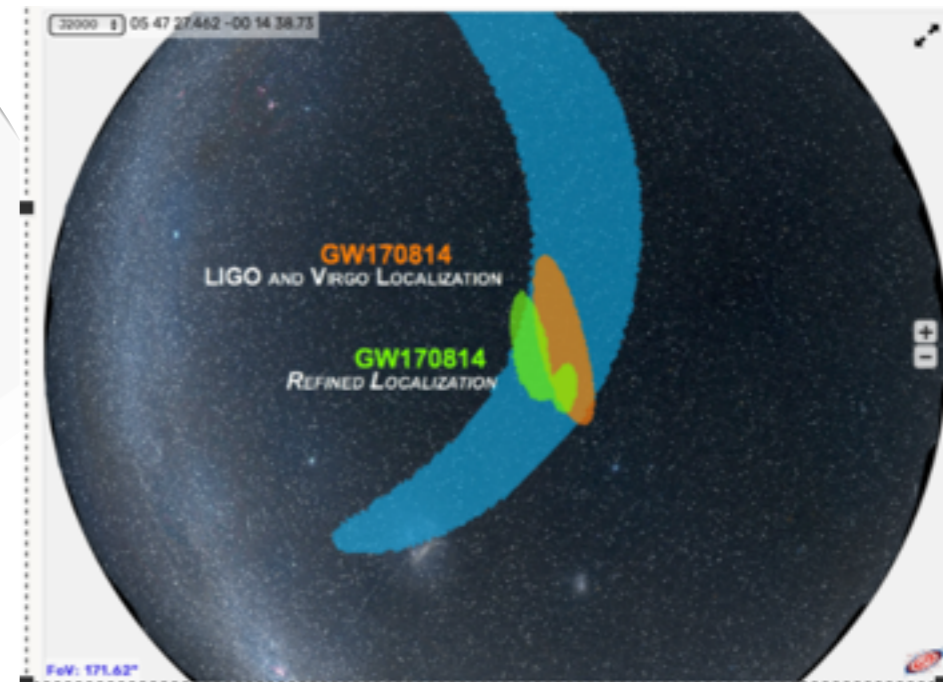
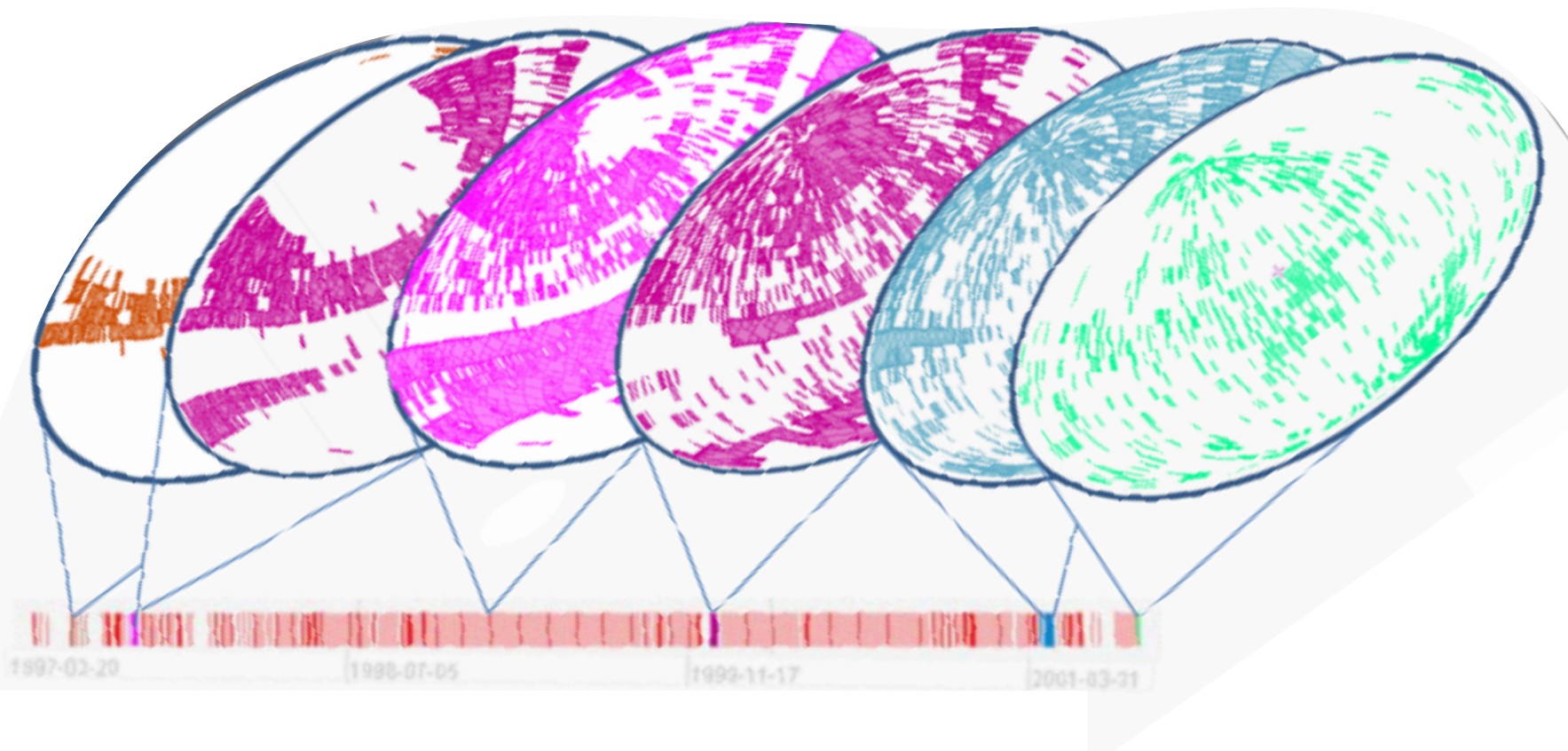
Offset: e.g. JD-XXX (e.g. Gaia...)

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)





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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

Version 1.1

Version 1.0

Author(s)

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Sébastien Derrière (CDS)

Editor(s)

Pierre Fernique, Ada Nebot, Daniel Durand

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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Raymond Plante, Alex Szalay, Roy Williams

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 Tocy, Patrick Dowler, Daniel Durand

Authors:

Mireille Louys, Doug Tocy, Patrick Dowler, Daniel Durand, Laurent Michel, Francis 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

ESO - European Southern Observatory

Object Observability

See also: [Object Observability - Airmass](#) - [Dark Skymap](#) - [Ecliptic](#)

XMM-NEWTON MULTI-TARGET VISIBILITY CHECKER

YOU CAN LOOKUP SIMBAD OR NED AGAIN, OR RUN THE VISIBILITY CHECKER USING...

Target Name: (eg. M31, M3)

RA: (eg. 00:42:44.330)

Dec: (eg. +41:16:07.00)

SIMBAD LOOKUP RESULTS:

Target Details:

RA: 00:42:44.330 (L21595833) (eg. 00:42:44.330)

Dec: +41:16:07.00 (L21595833) (eg. +41:16:07.00)

ISAAC NEWTON GROUP OF TELESCOPES

Object Visibility - STARALT

Mode: (Staralt, Startrack)

Night: or date when the local night starts. Staralt/Startrack only.

Observatory: (Select one above or specify your own site with this format: Longitude [East], Latitude [N], Altitude [meters], UTC offset (hours). Ex: 289.2767 -59.2183 2715 -4)

Coordinates: (S=0 -P=0)

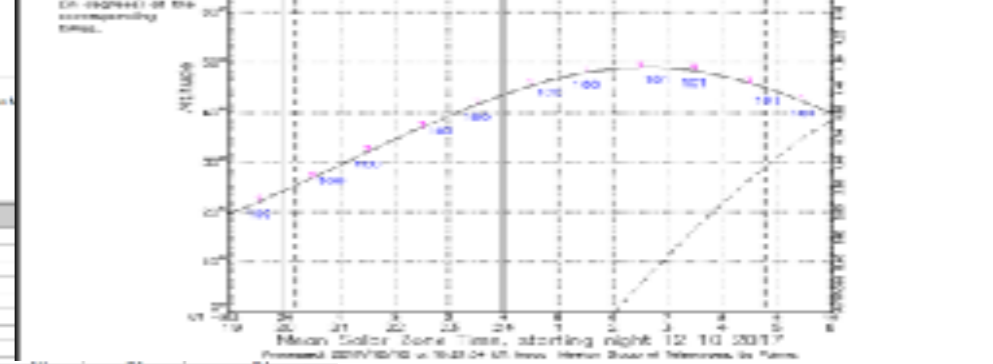
Graph: Altitude vs. Mean Solar Time. The graph shows a curve peaking at approximately 10:00 with an altitude of about 45 degrees.

The ESO Sky Calendar Tool

Observability for 05 23 34.5 -69 45 22

Date	RA	Dec	Alt	Az	Elev	Mag
2017 Nov 03	05 23 34.5	-69 45 22	10.5	100	10.5	10.5
2017 Nov 07	05 23 34.5	-69 45 22	10.5	100	10.5	10.5

RA	Dec	Alt	Az	Elev	Mag
00:42:44.330	+41:16:07.00	10.5	100	10.5	10.5



Different services have different inputs / outputs
 Facilitate the work by having some level of standardisation inputs / outputs

Coordination of observations

Integral Target and Scheduling Information

Schedule: **All executed** **Current revolution (1872)** **Future schedule** Revolution **1872** to **1872** [Show...](#) [show plot](#)

Schedule for revolution 1872

(this list is also available in csv-format, click [here](#) to download)

Rev	Start time (UTC)	End time (UTC)	Exp. time (s)	Target	Ra (J2000)	Dec (J2000)	Pattern	PI	Propo
1872	2017-10-10 10:29:15	2017-10-10 17:10:51	12080	Gal. Bulge region	17:45:36.00	-26:56:30.6	LICK	Erik Saulkers	142001
1872	2017-10-10 17:13:34	2017-10-11 07:55:58	30080	Galactic Center	17:52:11.21	-25:21:49.7	5x5_Seq	Joem Wilms	142002
1872	2017-10-11 08:16:46	2017-10-11 11:58:32	12680	Galaxy (l=0, b=0)	17:42:23.76	-29:38:02.4	HEX	Rashid Sunyaev	142003
1872	2017-10-11 12:26:36	2017-10-11 12:56:36	1880	Galaxy (l=0, b=30)	20:02:16.80	-41:20:31.2	HEX	Rashid Sunyaev	142004
1872	2017-10-11 13:27:21	2017-10-11 14:29:17	3680	Galaxy (l=0, b=30)	19:52:40.00	-41:05:16.6	LICK	Rashid Sunyaev	142005
1872	2017-10-11 15:00:12	2017-10-11 17:38:07	9080	Galaxy (l=0, b=30)	19:59:40.80	-41:05:16.6	HEX	Rashid Sunyaev	142006
1872	2017-10-11 18:41:00	2017-10-12 08:01:56	45080	GRS 1915+105	19:15:11.79	+10:56:45.7	5x5_Seq	Jerome Rodriguez	142007

Observing Schedules

Short Range Observatory Schedule

This is the intended schedule of INTEGRAL observations. This schedule of observations has been prepared in the observatory and will be executed automatically unless interrupted by a crew action. Targets of observation, or instrument and seasonal constraints. This schedule will cover various time ranges depending on the exposure time of the observations, but will usually be for a series of at least one week.

The SCHEDULE REPORTS are the EXP. TIME OF THE OBSERVATION OF THE TARGET, ALL THE OBSERVATIONS ARE TAKEN INTO ACCOUNT WITH RESOLUTION AND THE SAA OBSERVATION TIME WHICH OBSERVATION IS INTERRUPTED. THE OBS. TIME OF THE OBSERVATION IS THE EXP. TIME OF THE OBS. IN THE OBS. LEVEL. For more details see the INTEGRAL Science Team (IST) for the local use observations.

Obs. ID	Obs. ID	Target Name	RA (J2000)	DEC (J2000)	Exp. (s)	PI
2017-1872-01-0001	2017-10-10 10:29:15	Gal. Bulge region	17:45:36.00	-26:56:30.6	12080	Erik Saulkers
2017-1872-01-0002	2017-10-10 17:13:34	Galactic Center	17:52:11.21	-25:21:49.7	30080	Joem Wilms
2017-1872-01-0003	2017-10-11 08:16:46	Galaxy (l=0, b=0)	17:42:23.76	-29:38:02.4	12680	Rashid Sunyaev

Observing Schedules

Long Range Observatory Schedule

This is the intended schedule of INTEGRAL observations. This schedule of observations has been prepared in the observatory and will be executed automatically unless interrupted by a crew action. Targets of observation, or instrument and seasonal constraints. This schedule will cover various time ranges depending on the exposure time of the observations, but will usually be for a series of at least one week.

The SCHEDULE REPORTS are the EXP. TIME OF THE OBSERVATION OF THE TARGET, ALL THE OBSERVATIONS ARE TAKEN INTO ACCOUNT WITH RESOLUTION AND THE SAA OBSERVATION TIME WHICH OBSERVATION IS INTERRUPTED. THE OBS. TIME OF THE OBSERVATION IS THE EXP. TIME OF THE OBS. IN THE OBS. LEVEL. For more details see the INTEGRAL Science Team (IST) for the local use observations.

Scheduling Unit	Begin UT	End UT	Exp. #	Target	Instrument	Aperture	Resolution	Exposure	Obs. ID
2017-1872-01-0001	2017-10-10 10:29:15	2017-10-10 17:10:51	12080	Gal. Bulge region	ISGRI	300	1.5	12080	1872-01-0001
2017-1872-01-0002	2017-10-10 17:13:34	2017-10-11 07:55:58	30080	Galactic Center	ISGRI	300	1.5	30080	1872-01-0002
2017-1872-01-0003	2017-10-11 08:16:46	2017-10-11 11:58:32	12680	Galaxy (l=0, b=0)	ISGRI	300	1.5	12680	1872-01-0003

XMM-NEWTON SHORT-TERM SCHEDULE

The Short-Term Schedule gives an overview of scheduled observations covering the time range from the past week until the upcoming 2-4 weeks.

Background: The planning and scheduling procedure is described in [Annex 1.2 of the Mission and Procedures](#). In addition, the process of scheduling XMM-Newton observations is described in [Annex 1.3 of the Mission and Procedures](#).

Details: Each row lists the observation ID (OBSID), observation start time (UTC), target name, pointing coordinates (right ascension and declination), start and stop times, prime instrument, accumulated exposure times (in seconds) for each instrument (without overhead), and name of the Principal Investigator (PI). The start and stop times refer to the instrument activities required to perform the observation. The exposure times are accumulated over all exposures taken with the same instrument. Especially for UM, the observation can be split in several exposures with different instruments (SPI), exposure times in brackets indicate that one or all exposures use the color filter. Details can be seen when clicking on the OBSID.

The normalized flux indicates the target that is scheduled for the time of the last table update. The position data is given at the top of the table.

Filters: The scheduling of an XMM-Newton revolution may have to be revised (see Sects. 1.5, 1.1, and 1.2.2 of the Mission and Procedures). Contamination of any type and solar flaring activity may impact at different levels the scheduled programme. The [Observation Log Browser](#) can be checked to see what was actually done.

Update frequency: Every 6 hours an updated version is updated (new revolution past-rev or any existing updated). The latest available version can be viewed after clicking the browser button for the contents of any previous sessions.

LAST UPDATE ON: 2017-10-11 12:41:33 UT (PI: REV = 1871)

Obs. ID	Target Name	RA	DEC	RA	UTC Obs Start	UTC Obs End	Prime Inst.	PI	MOS1	MOS2	EPIC	RM	PI
1278 0801504C1	ESO218-IG006	08:24:27	-37:46:57	18.83	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	18.7	18.1	18.5	18.2	18.3	Peter Beaman
1279 0801070C1	1B 0109	09:21:40	-09:34:17	16.03	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	9.5	10.8	10.9	11.0	10.5	7800 Evans
1278 0801381C1	zoo Pupp	08:01:40	-40:00:30	112.80	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	44.5	44.9	44.9	45.0	47.3	Phil Warren
1278 0801980C1	0055	09:21:16	+36:43:17	118.83	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	16.6	16.6	16.6	17.0	16.8	Quito
1279 0802240C1	202017-08-0340800	07:26:27	-18:49:38	81.37	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	11.3	12.8	12.8	13.0	12.8	Nathan Sorensen
1279 0801980C1	SATLAP18	04:01:55	-47:46:06	156.87	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	43.4	44.8	44.8	44.9	43.7	Franck Cappadona
1279 0801980C1	0445-0453	14:45:24	-04:53:24	138.82	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	42.9	43.9	43.9	44.0	42.9	Patrick Kavanagh
1279 0803020C1	3055	08:26:10	-11:48:18	101.78	2017-03-200917-10:20	2017-03-200917-10:20	EPIC	38.0	33.4	37.8	33.8	37.3	Quito

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



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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



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Object Visibility Simple Access Protocol

Version 0.5

IVOA Working Draft 19 March 2019

This version:

ObjVisSAP-0.5-20190319

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ObjVisSAP-0.4-20180912

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Working Group:

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Editor(s):

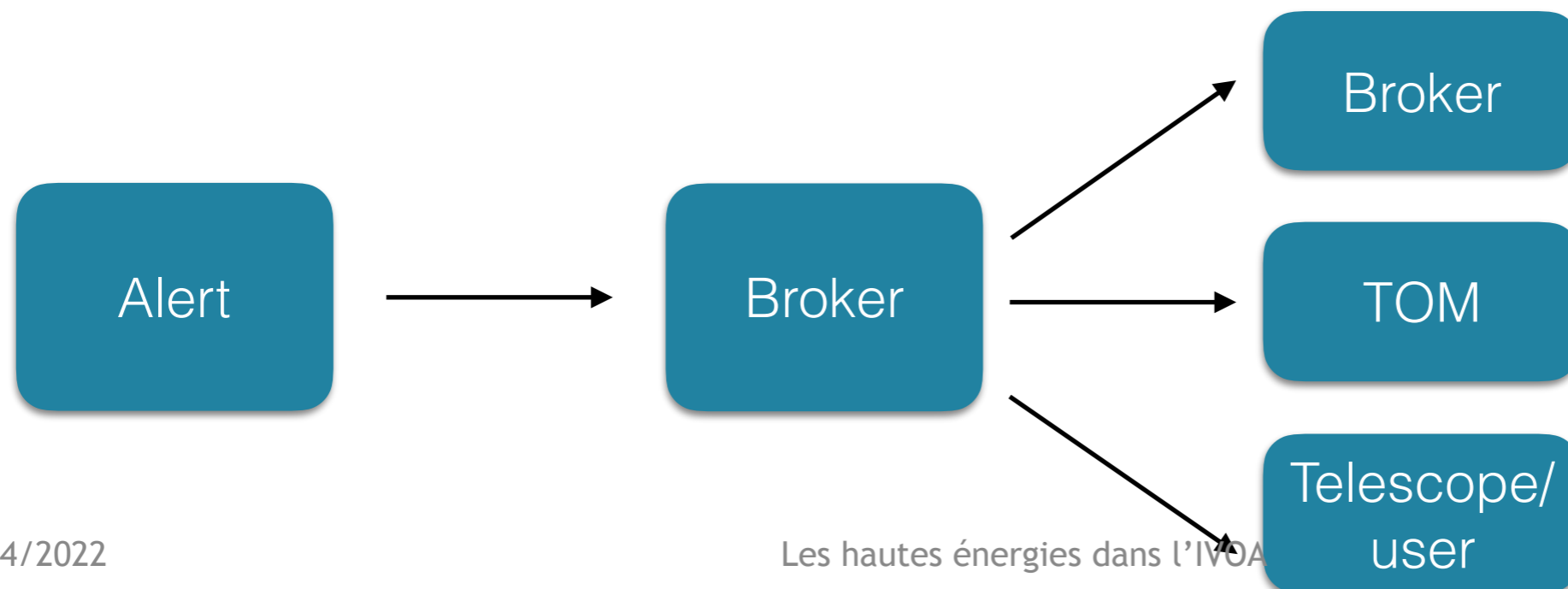
Aitor Ibarra, Richard Saxton, Jesús Salgado

Author(s):

Aitor Ibarra, Richard Saxton, Jesús Salgado, Matthias Ehle, Carlos Gabriel, James Dempsey, María Díaz Trigo, Yue Huang, Jaime Keenea, Mark Kettenis, Peter Kretschmar, Erik Kuulkers, Uwe Lammers, Giorgio Matt, Bruno Merin, Marco Molinaro, Jan-Uwe Ness, Julian Osborne, Emma de Oña Wilhelmi, Edward J. Salbol, Emilio Salazar, Celia Sánchez, Gregory Sivakoff, Lian Tao, Aaron Tohuvavohu, Bill Workman
TBC: Representatives of a large multi-observatory collaboration

□ Alerts

1. VOEvent (REC):
 1. Container \rightarrow XML
 2. Content \rightarrow 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 (10^3 Hz)
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

Interes/Working Group:

<http://www.ivoa.net/wiki/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

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/ivoaResReg>

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.C302H

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.

□ 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>

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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.

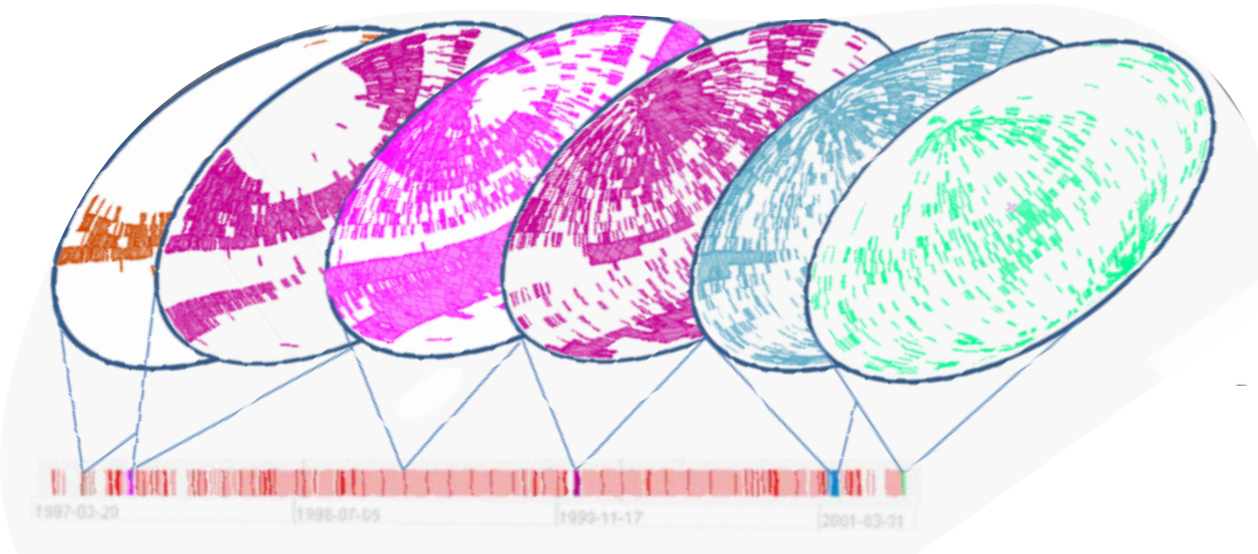
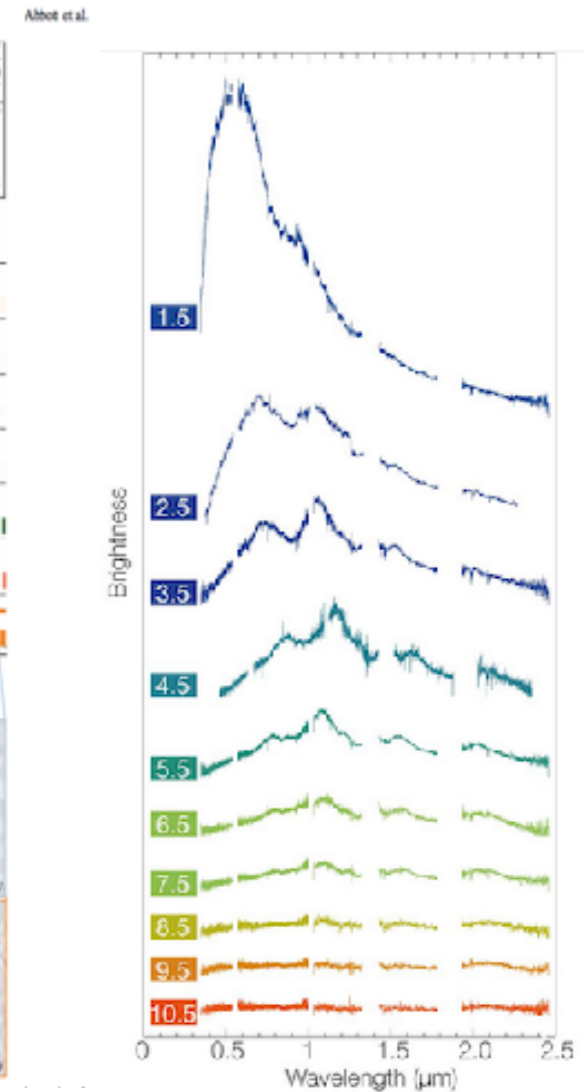
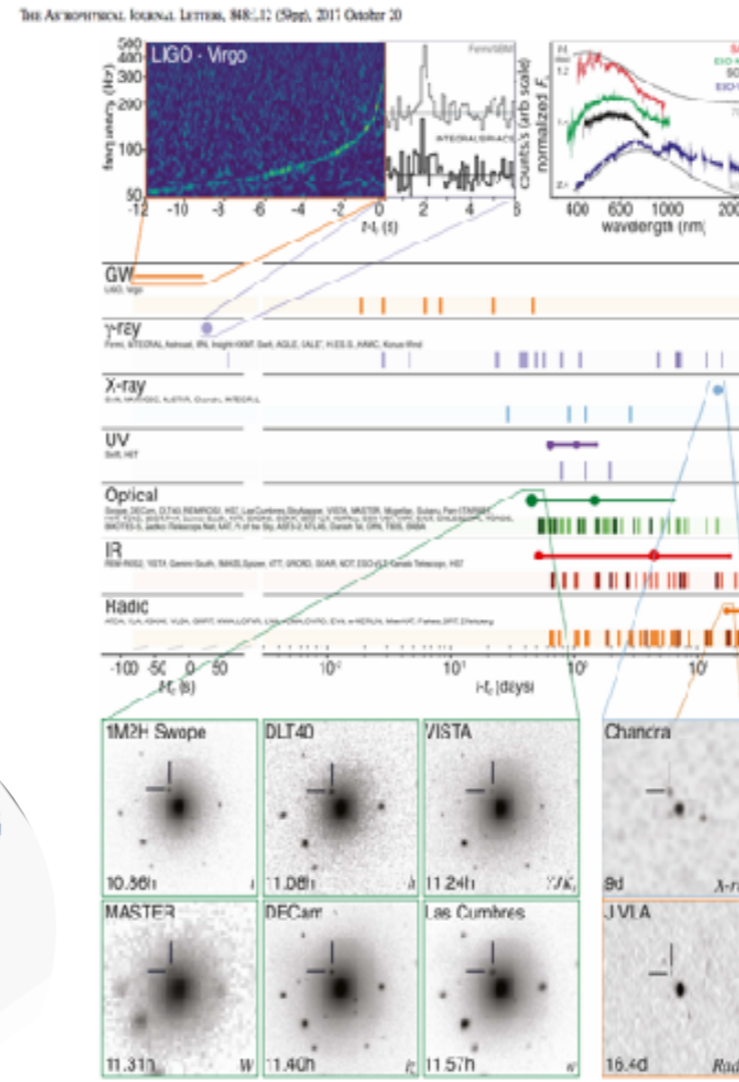
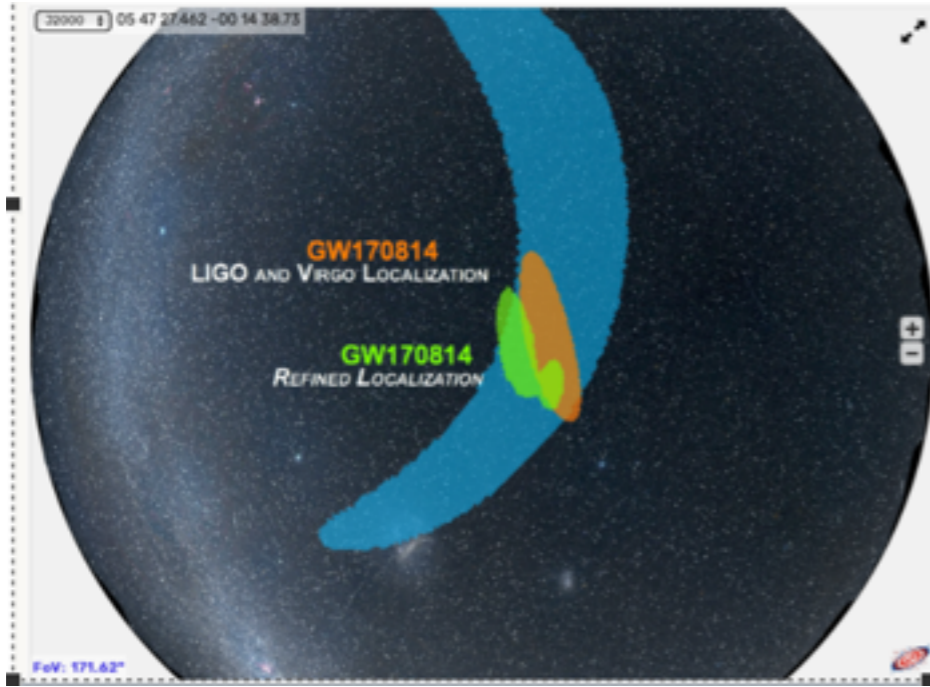
Status of this document

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>
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