IVOA Newsletter - March 2022

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IVOA Newsletter Editors: Giulia Iafrate and Stefania Amodeo.

The International Virtual Observatory Alliance (IVOA) was formed in June 2002 with a mission to facilitate the international coordination and collaboration necessary for the development and deployment of the tools, systems and organizational structures necessary to enable the international utilization of astronomical archives as an integrated and interoperating virtual observatory. The IVOA now comprises 20 VO programs from Argentina, Armenia, Australia, Brazil, Canada, Chile, China, Europe, France, Germany, Hungary, India, Italy, Japan, Russia, South Africa, Spain, Ukraine, the United Kingdom, and the United States and an inter-governmental organization (ESA). Membership is open to other national and international programs according to the IVOA Guidelines for Participation. You can read more about the IVOA and what we do at http://ivoa.net/about/.

What is the VO?
The Virtual Observatory (VO) aims to provide a research environment that will open up new possibilities for scientific research based on data discovery, efficient data access, and interoperability. The vision is of global astronomy archives connected via the VO to form a multiwavelength digital sky that can be searched, visualized, and analyzed in new and innovative ways. VO projects worldwide working toward this vision are already providing science capabilities with new tools and services. This newsletter, aimed at astronomers, highlights VO tools and technologies for doing astronomy research, recent papers, and upcoming events.

IVOA NEWS

2021 Northern Fall Interoperability Meeting Overview
Janet Evans, Marco Molinaro and Patrick Dowler

The Northern Fall Interop meeting was held Nov 02-04, 2021 via Zoom with 182 registered participants from all around the globe. Interop meetings are held every ~6 months and this was our fourth virtual meeting since the start of the global pandemic. Sessions were recorded and posted so that if you missed a session you can go back and view it. Here is the link if you are interested in session videos.

The sessions were led by the IVOA Working Groups (WG) and Interest Groups (IG) and focused on core topics related to status and discussion of current group efforts. Community presentations were solicited and folded into sessions to provide a balance between contributed and core topics. In addition a Newcomers session and a session sponsored by the Committee for Science Priorities (CSP) rounded out the meeting. The Newcomers session was sponsored by the Education Interest Group and held the day before the opening of the Interop. Several scientific use cases were demoed using VO-standards and protocols. The aim was to help newcomers understand the structure of the IVOA and how Interop meetings are organized in order to get the most out of the upcoming meeting. We plan on regular Newcomers sessions at Interop meetings going forward. The CSP session titled “Bringing services and tools to the research community” welcomed presentations by projects on their IVOA support status and community involvement. Panelists from NASA Astronomical VO (NAVO), IPAC, Spanish VO, Chandra, ASVO, and ESA presented overviews of their project efforts. A discussion led by the CSP chair followed and focused on topics of interest and a vision toward the future.

A new and important IVOA Architecture document (lead author Pat Dowler) was released just before the meeting. The document represents the current status of the IVOA Architecture. You can find descriptions of the IVOA Level 0, 1, and 2 architecture, a dependency diagram showing the relationships between IVOA standards, a summary description of each standard, and links to each of the full standard documents. Here is a link if you are interested in reviewing the document

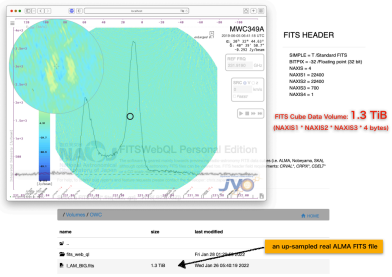
The Closing Plenary and presentation by the TCG, emphasized progress of standards over the last 6 months, and reminded the audience of the Technical Coordination Group (TCG) and their role in the IVOA. The TCG is made up of Chairs and Vice-Chairs of working groups, interest groups, and committees. They are tasked with building consensus in the WG and community, assure coordination between WG/IG & the Committee for Science Priorities (CSP), liaison with the Executive committee, and support committee roles in the IVOA documents and standards process. TCG membership has a 3 year term with a possible 1 year extension. Members of the astronomical community are welcome to get involved in the IVOA and to consider a role in the TCG.

Here are several links to get involved:

IVOA Website	https://www.ivoa.net/	Place to start
IVOA Wiki pages	https://wiki.ivoa.net/	Collaboration area
Main Mailing List	interop 'at' ivoa.net	IVOA community list
All Mailing Lists	https://www.ivoa.net/members/	Identifies email lists for all WG/IG, CSP & Exec.
Slack	https://ivoa.slack.com/	Collaboration slack channel
Github	https://github.com/ivoa	Collaboration development/new ideas
Github	https://github.com/ivoa-std	Standard document development

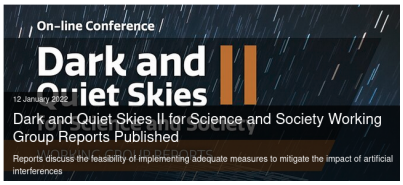
JVO Breaking Through the 1TB Barrier
Christopher Zapart, Yuji Shirasaki, Masatoshi Ohishi, Yoshihiko Mizumoto

Recently the Japanese Virtual Observatory (JVO) - part of the National Astronomical Observatory of Japan - has gained an important new capability. Using a 28 CPU-core Mac Pro workstation equipped with 1.5TB of RAM and



running a normal production version of Rust FITSWebQL v4, they have demonstrated a smooth real-time preview of a 1.3TiB-large FITS file. FITSWebQL calculates in real-time the "-1" and "0" moments for FITS data cubes, which places extra stress on the server memory and CPU. In addition to the stable FITSWebQL v4, work is progressing on the distributed-computing FITSWEBQL v5 Supercomputer Edition, with the aim to offer in real-time selected higher moments too. In a quest to deliver the most performant system, during the development process FITSWEBQLSE has undergone many drastic language changes, going from Rust to C/C++, followed by CoArray Fortran & C, then switching over to Julia, and finally turning to "plain" C / FORTRAN coupled with custom distributed computing. For more details please visit https://github.com/jvo203/FITSWEBQLSE and http://jvo.nao.ac.jp/portal/alma/archive.do.

VO supports the IAU protection efforts of the Dark and Quiet Sky
Chenzhou Cui



At a press conference on 3 February 2022, the International Astronomical Union announced the selection of the SKA Observatory (SKAO) and NSF's NOIRLab as co-hosts of the new IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference. The Centre coordinates collaborative multidisciplinary international efforts with institutions and individuals and works across multiple geographic areas to help mitigate the negative impact of satellite constellations on ground-based optical and radio astronomy observations as well as humanity's enjoyment of the night sky. China-VO (National Astronomical Data Centre of China) and several other VO colleagues have gotten involved into the new center as Institutional Contributors and Individual Contributors.
On 12 January 2022, Dark and Quiet Skies II for Science and Society Working Group report was published online. The report discuss the feasibility of implementing adequate measures to mitigate the impact of artificial interferences. In October 2021 more than 700 people from 76 countries took part in the United Nations/Spain/International Astronomical Union Conference on Dark and Quiet Skies for Science and Society online. The results of this meeting are contained in the report.
Section 6.1 "Standards from the Virtual Observatory for SatHub" was contributed by China-VO. In the Section, VO and IVOA backgrounds are introduced briefly. VO standards and tools, like HiPS and WWT, and their potential contributions to SatHub are discussed. SatHub will act as a central virtual clearinghouse and repository for the coordination of effort and dissemination of data and information.

SCHOOLS AND WORKSHOPS

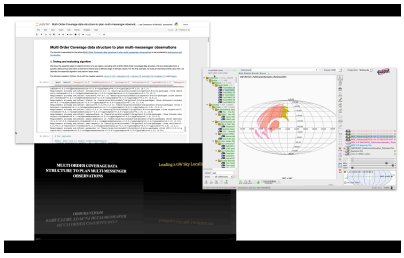
Second ESCAPE Virtual Observatory School
Stefania Amodeo

The ESCAPE project held its second international Virtual Observatory (VO) school on February 22-24 and on March 4th 2022. As in the previous schools organised by the Euro-VO initiative, the goal was to promote and enhance the VO as framework to exploit the huge amount of data provided by the ever-growing number of ground-based and space facilities, as well as to gather requirements and feedback from the participants. VO experts gave hands-on tutorials on the usage of VO tools and services in "real life" examples of scientific applications, including the exploration of large catalogues like Gaia, cross-matching of big survey data, exploration of transient events and electromagnetic follow-up of gravitational-wave events. The last day was dedicated to the participants science cases and their own use of the VO-skills learned during the school. Planned initially as a hybrid meeting at the Observatoire Astronomique de Strasbourg and online, the school took place online exclusively due to the persistence of the pandemic situation. More information on the school, including the tutorial material can be found here.

Access more scientific usage tutorials here

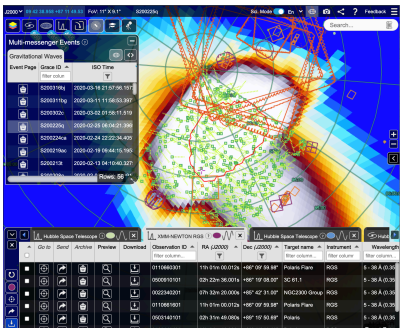
VO APPLICATIONS AND IMPLEMENTATION HIGHLIGHTS

MOCs in action for multi-messenger astronomy
Mark Allen, Giuseppe Greco



The IVOA standardised Multi Order Coverage (MOC) maps offer practical ways to manage complex regions of the sky. In a new Astronomy and Computing paper, "Multi Order Coverage data structure to plan multi-messenger observations" Greco et al. 2022 presents an application of MOC, in combination with the astroplan observation planning package to enable the efficient computation of sky regions and the visibility of these regions from a specific location on the Earth at a particular time. The published article includes an associated Jupyter notebook and a video demonstration of the workflow which provides the basis of a new tutorial in the Second ESCAPE Virtual Observatory School.

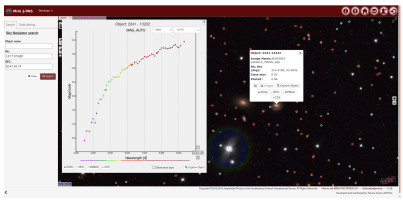
Multi-messenger astronomy with ESASky



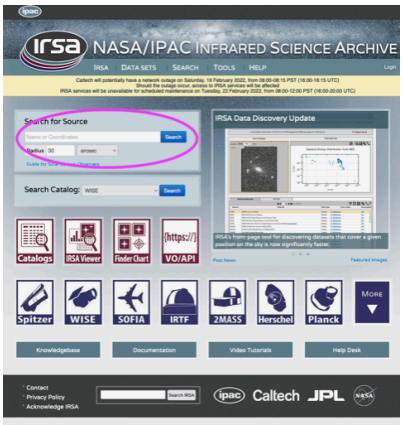
Deborah Baines

ESASky is a science-driven discovery portal developed at the European Space Agency's ESAC Science Data Centre that allows the interactive exploration of a large collection of astronomical data, providing a very useful tool for exploring the multi-wavelength sky with the click of a button. The latest release of ESASky is branching into multi-messenger astronomy and shows gravitational wave (GW) event probability maps on the sky, allowing users to look for electromagnetic counterparts for the GW events and using ESASky to quickly access all available archival electromagnetic data. Near future releases intend on expanding the multi-messenger feature and include, for example, the IceCube neutrino footprint.
Additionally, the latest releases of ESASky have increased the amount of science ready data accessible through the tool. These include: all public CHEOPS observational metadata and light curves; new and updated catalogues in the high energy domain (such as Data Release 11 of the Fourth XMM-Newton Serendipitous Source catalog and the Fermi-LAT 10-year source catalog); HiPS from PanSTARRS and ASTRON (the TGSS ADR progressive survey and Apertif Data release 1 survey); the ability to include any HiPS from a URL, local computer or by browsing the CDS HiPS list for globally available HiPS; and the external Table Access Protocol (TAP) service has been expanded too, complementing the access to MAST, ESO and CADC data with the access to ASTRON and the HEASARC master catalogs.
Finally, in collaboration with the ESA/Hubble team, ESASky now provides access to the Hubble outreach images on the ESA/Hubble website. Users can tour the Hubble outreach images overlaid on the sky, read the explanation about each image and link to the appropriate ESA/Hubble outreach image page.
More information: https://sky.esa.int and how to use ESASky.

The CEFCA Catalogues Portal VO Services
Tamara Civera



The Centro de Estudios de Física del Cosmos de Aragón (CEFCA) is carrying out from the Observatorio Astrofísico de Javalambre (OAJ, Teruel, Spain) two large area multiband photometric sky surveys, J-PLUS, and J-PAS, covering the entire optical spectrum using narrow and broad band filters. J-PAS and J-PLUS include coadded and individual frame images, dual and single catalogue data generated from coadded images, and photo-redshift computations.
All this survey data (at the present moment, J-PLUS DR1 and DR2 and MiniJ-PAS PDR201912) is offered through the CEFCA Catalogues portal which provides advanced tools for data search, visualization and download. This powerful portal includes web user interface services such as sky navigator, object visualization, object list search, ADQL asynchronous queries interface, cone search and image search and download. All these services support SAMP protocol to interoperate and communicate with VO-compatible applications. The CEFCA catalogues portal also offers all this data through Virtual Observatory (VO) services like SIAP, SCS, TAP and catalogue and images HIPS. More information: http://archive.cefca.es.



IRSA's data discovery faster with MOCs
Vandana Desai

The NASA/IPAC Infrared Science Archive (IRSA) has now a significantly faster front-page tool for discovering datasets that cover a given position on the sky. These performance gains were made possible by the adoption of the IVOA standard for multi-order coverage (MOC) maps, which are now regularly updated for all IRSA holdings.

SOME RECENT PAPERS ABOUT VO-ENABLED SCIENCE

Featured Science Publication

The GALAH+ survey: Third data release
Buder, Sven et al.
Monthly Notices of the Royal Astronomical Society, Volume 506, Issue 1, pp.150-201
Abstract. The ensemble of chemical element abundance measurements for stars, along with precision distances and orbit properties, provides high-dimensional data to study the evolution of the Milky Way. With this third data release of the Galactic Archaeology with HERMES (GALAH) survey, we publish 678 423 spectra for 588 571 mostly nearby stars (81.2 per cent of stars are within <2 kpc), observed with the HERMES spectrograph at the Anglo-Australian Telescope. This release (hereafter GALAH+ DR3) includes all observations from GALAH Phase 1 (bright, main, and faint survey, 70 per cent), K2-HERMES (17 per cent), TESS-HERMES (5 per cent), and a subset of ancillary observations (8 per cent) including the bulge and >75 stellar clusters. We derive stellar parameters Teff, log g, [Fe/H], vmic, vbroad, and vrad using our modified version of the spectrum synthesis code Spectroscopy Made Easy (SME) and 1D MARCS model atmospheres. We break spectroscopic degeneracies in our spectrum analysis with astrometry from Gaia DR2 and photometry from 2MASS. We report abundance ratios [X/Fe] for 30 different elements (11 of which are based on non-LTE computations) covering five nucleosynthetic pathways. We describe validations for accuracy and precision, flagging of peculiar stars/measurements and

recommendations for using our results. Our catalogue comprises 65 per cent dwarfs, 34 per cent giants, and 1 per cent other/unclassified stars. Based on unflagged chemical composition and age, we find 62 per cent young low-α, 9 per cent young high-α, 27 per cent old high-α, and 2 per cent stars with [Fe/H] ≤ -1. Based on kinematics, 4 per cent are halo stars. Several Value-Added-Catalogues, including stellar ages and dynamics, updated after Gaia eDR3, accompany this release and allow chrono-chemodynamic analyses, as we showcase.
DOI: 10.1093/mnras/stab1242

Refereed Publications

The full list of refereed publications from September 2021 to March 2022 can be found at the following list, curated by the Spanish Virtual Observatory.

More Ways to Find VO-related Publications

All ADS links mentioning the "virtual observatory" in the abstract.

All refereed publications mentioning the "virtual observatory" in the abstract.

VO CALENDAR

24 - 29 April 2022 - IVOA Interoperability Meeting
Online
The International Virtual Observatory Alliance (IVOA) semi-annual Interoperability meetings provide an opportunity for discussion and development of virtual observatory standards and VO-based applications, and are open to those with an interest in utilizing the VO infrastructure and tools in support of observatory operations and/or astronomical research. The Northern Spring 2022 IVOA Interoperability meeting will be a virtual conference.

12 - 16 June 2022 - 240th AAS Meeting
Pasadena, California, USA
The American Astronomical Society (AAS) meetings serve as a venue for the general astronomical community to gather and discuss the latest science, tools, and technologies in astronomy. VO-related sessions and exhibits will be held during the meeting, including presentations from international VO partners, open to all astronomers. IVOA affiliated institutions will have booths in the exhibition hall throughout the week, demonstrating tools and services such as the NASA Astrophysics Data System, SciServer, VizieR, and other VO data access interfaces. Attendees may learn more about the data and services provided by those institutions, and have face-to-face discussions with developers.

27 June - 1 July 2022 - EAS Annual Meeting 2022
Valencia, Spain
The European Astronomical Society (EAS) Annual Meeting (formerly known as EWASS, and earlier JENAM) has more than 25 years of tradition and it has imposed itself as the largest conference for European astronomy. In addition to plenary sessions and the award of prestigious prizes, the conference hosts many symposia held in parallel, as well as special sessions and meetings. IVOA affiliated institutions will have booths in the exhibition hall throughout the week, demonstrating tools and services such as CDS's VizieR and Aladin, ESO tools and services, ESA archives, and other VO data access interfaces. Attendees may learn more about the data and services provided by these institutions and have face-to-face discussions with scientists and developers.

17 - 21 October 2022 - IVOA Interoperability Meeting
Online
The International Virtual Observatory Alliance (IVOA) semi-annual Interoperability meetings provide an opportunity for discussion and development of virtual observatory standards and VO-based applications, and are open to those with an interest in utilizing the VO infrastructure and tools in support of observatory operations and/or astronomical research. The Northern Fall 2022 IVOA Interoperability meeting will be a virtual conference.

31 October - 4 November 2022 - ADASS XXXII
Online
This annual Astronomical Data Analysis Software and Systems (ADASS) conference, held in a different location each year, is a forum for astronomers, computer scientists, software engineers, faculty members and students working in areas related to algorithms, software and systems for the acquisition, reduction, analysis, and dissemination of astronomical data. The ADASS XXXII program will include invited talks, contributed papers, display sessions, tutorials, computer demonstrations, and special interest (“Birds of a Feather” or BoF) meetings.