IVOA Newsletter - August 2018

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IVOA Newsletter Editors: Deborah Baines, Bruce Berriman, Jamie Anne Budynkiewicz, Theresa Dower, Giulia Iafrate, Shanshan Li, Simon O'Toole, Yihan Tao.

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

Gaia DR2 and the VO: A two-way success story

When, on 25th April at 12:00 sharp, thousands of astronomers opened TOPCAT, searched for “Gaia DR2” and found four services (ARI, CDS, ESA, GAVO) willing to answer significantly complex queries over the impressive 1.7 billion source catalogue, very few were aware that perhaps the most intensive and decisive operational test since the formation of the VO in 2002 was running at that precise moment.

And it was a successful test. The VO behaved as good technology should behave: transparent to the users whilst empowering them to perform scientific queries without noticing the complexity of the standards and technologies served behind the tools. These include writing queries in a common, open IVOA standard (ADQL; Astronomical Data Query Language), accepted by all services; sending data through interoperable applications with one click with SAMP (Simple Application Mesaging Protocol); saving and sharing data through VOSpace services; and data distribution through DataLink.

As well as using TOPCAT, many users decided to use the ESA Gaia Archive interface, Partner Data Centres interfaces at: Centre de Données astronomiques de Strasbourg (CDS), Astronomisches Rechen-Institut (ARI), Leibniz-Institute for Astrophysics Potsdam (AIP) and the ASI Space Science Data Center (SSDC), other VO tools, or the specifically developed Python Astroquery Gaia library. Usage numbers for the first week speak for themselves: 34000 users accessed the ESA Gaia Archive interface with peaks of 1700 new users per hour, over 5000 users sending more than 1.5 million data analysis queries and a total data retrieval of 118 TB.

The VO-orientation of the ESA Gaia archive and partner archives and services is the result of many years of involvement of ESA and the Gaia partner data centres in the IVOA, and of the contributions through the Gaia Data Processing and Analysis Consortium (DPAC) of many partners and experts. VO technologies are now "release proven" (i.e. can accept very large peak loads), combining reliability with functionality, and making them an attractive option for future missions and projects.

IVOA meeting in Victoria, BC, Canada
The Northern Spring meeting of the IVOA took place in Victoria, BC, Canada, between 27 May and 1 June 2018. This meeting was hosted by the Canadian Astronomy Data Centre (CADC).

In this meeting we had the first IVOA Hackathon, organized by the Data Model Working Group. This Hackathon provided useful feedback to the data modelers as well as informing the participants of available software tools. General consensus was that similar hands on sessions should become a standing feature of IVOA meetings.

The IVOA Committee for Science Priorities organized a special session with representatives of the Astropy community, to foster increasing collaboration between Data Center/Archive data providers and the astronomy user community. The IVOA will make increasing use of GitHub for standards development, to make them more visible to astronomers at large. Development of Python software based on IVOA standards was also discussed.

The IVOA will host a booth at the upcoming IAU meeting in Vienna. All are invited for discussions and demonstrations of tools and interfaces.

More information: http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpMay2018MeetingtPage

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SCHOOLS AND WORKSHOPS

China-VO Alibaba Astronomy Party and LAMOST Spectrum Data Mining Competition

China-VO has recently made some efforts to promote Information Technology and data mining in astronomy. On 10-11 April, China-VO and Alibaba Cloud jointly organized an astronomy party in the Alibaba Group headquarter in Hangzhou, China. The party aimed to connect astronomers with IT experts in industry and find partners to help with the technical issues in their research projects. Researchers from nine astronomy research institutes in different area of China participated in the party and brought about 40 astronomical research projects and technical requirements, e.g. FAST pulsar searches, exoplanet searches, etc. More than 50 volunteers from various divisions of the Alibaba group, who are keen on astronomy, joined the party. Online discussion groups have formed since the party on different technical aspects, including web crawlers, machine learning, engineering, and big data processing.

From February to May 2018, an Algorithm Competition on spectral classification was organized by China-VO and Alibaba Cloud. Around 1000 people (over 800 teams) from the public have participated in the competition, applying machine learning techniques on LAMOST spectral datasets to automatically classify the spectra into stars, galaxies, quasars and unknowns. The winning team employs deep neural networks to solve the problem and achieves an overall macro-F1 score of 0.83.

These activities are new attempts of China-VO in terms of bridging astronomers with the technical community and combining astronomy research with public science in ways that both astronomers and the general public could benefit from.

NAVO python session at 232nd AAS

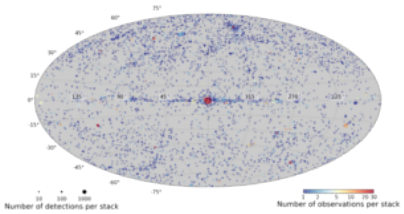
Representatives from the NASA Astronomy Virtual Observatory (NAVO) conducted a workshop at the 232nd American Astronomical Society Meeting in Denver. Forty students registered for "Using Python to Search NASA's Astrophysics Archives", and spent 1.5 hours working through Jupyter notebooks illustrating how to access Virtual Observatory resources to study a sample of interacting galaxies. Examples included queries of the NAVO Directory, Simple Cone Search, Table Access Protocol, Simple Image Access, and Simple Spectral Access. Given the high demand, NAVO plans to offer workshops at future AAS meetings.

Workshop materials: https://github.com/NASA-NAVO/aas_workshop_2018_summer

Access more scientific usage tutorials here

VO APPLICATIONS AND IMPLEMENTATION HIGHLIGHTS

Chandra Source Catalog (CSC 2.0)

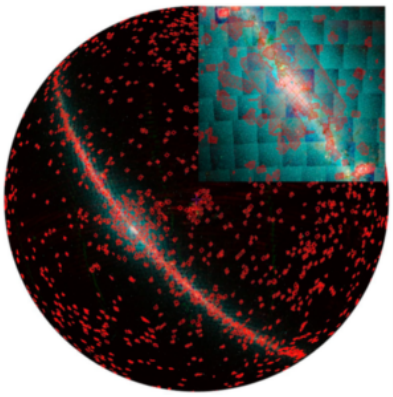


The second major release of the Chandra Source Catalog (CSC 2.0) is approaching completion, and access to data that have completed processing is currently possible through the CSCview user interface. CSC 2.0 will roughly triple the size of the current version of the catalog to an estimated 375,000 X-ray detections, corresponding to ~315,000 unique X-ray sources on the sky. For each detected X-ray source, the catalog provides a detailed set of properties including the source position and associated position error ellipse, source extent, multi-band aperture photometry probability density functions, spectral fits using several source models, hardness ratios, and intra- and inter-observation temporal variability measures. All numerical measures have associated two-sided confidence intervals. In addition to tabular data, the catalog provides FITS data products that are immediately suitable for further user analysis, including per-field and per-source images, source region polygons, photon event lists, responses, spectra, and light curves.

Access to the version 1.1 release of the catalog is also possible through IVOA compliant SIAP, SCS, and TAP interfaces. Once version 2.0 is officially released, the new versions of the catalog will also be accessible through these interfaces.

This work has been supported by NASA under contract NAS 8-03060 to the Smithsonian Astrophysical Observatory for operation of the Chandra X-ray Center.

For more information see the CSC 2.0 website at http://cxc.harvard.edu/csc2/



Chandra adoption of Multi-Order Coverage maps (MOCs)
As Chandra approaches its 20th year of operation, the total fraction of sky observed is nearing the 2.2% mark. A map showing the footprints of all Chandra public observations would resemble a large and sparse collection of isolated rectangular shapes, a few islands of closely and orderly positioned tiles and a patchwork of large, often connected regions, typically associated with structures in the nearby Universe.

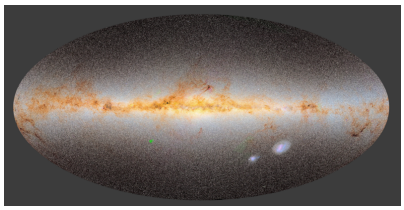
Now, such a map (and more) is available for everyone to admire and work with at http://cxc.cfa.harvard.edu/cda/cda_moc.html !

In order to help astronomers interested in the coverage properties of Chandra data, the Chandra Data Archive (CDA) has recently generated and made available up-to-date Multi-Order Coverage maps (MOCs) of Chandra archival observations at different maximum spatial resolutions. These MOCs, described by the IVOA standard, combine the field-of-views of the distinct observations into a conveniently compressed global representation of their coverage. MOCs are optimized for interactive exploration but can also be used to filter lists of positions based on their positions relative to the Chandra footprint. Morever, MOCs make it easy to estimate the global properties of the Chandra coverage (i.e. total area), and apply boolean operators to the Chandra footprint and the footprints of other observations. These operations can be performed either via GUI tools such as TOPCAT and Aladin Desktop, or programmatically, using MOC-compatible libraries such as STILTS or Python libraries MOCPy and PyMOC.

MOCs will complement the other Chandra data access interfaces and services by providing a novel representation of the geometric properties of the Chandra archival observations, thus making the X-ray Universe seen by Chandra more easily discoverable and explorable.

More information: http://cxc.cfa.harvard.edu/cda/cda_moc.html

Gaia DR2 in CDS Services
Gaia DR2 data are available since April 25th in CDS services: VizieR, Aladin, Sesame and the CDS cross-matching service.



In addition to the regular VizieR interface, VO access is provided through cone search queries and through TAP allowing the user to formulate SQL-like queries from our web interface or from any TAP client (Topcat or TAPHandle for instance). For power users, a command-line tool find_gaia_dr2 allows users to query Gaia DR2 by position, source ID or by constraints on the parallax, proper motions, fluxes, etc.

Aladin Desktop features a dedicated form for easy access to Gaia data and visualisation of proper motions.

The cross-match service offers fast spatial cross-identifications of Gaia data with VizieR 18,000+ tables with positions or user-uploaded tables. Access to the cross-match is done either via our web page or via Topcat.

Gaia DR2 has also been made available as HiPS progressive catalogues, seamlessly browsable from Aladin Desktop and Aladin Lite as demonstrated here: http://cds.unistra.fr/Gaia/DR2/AL-visualisation.gml, including a HiPS density map and a color flux map created by CDS from the Gaia catalogue.

More information: http://cds.unistra.fr/GaiaDR2News

HIPASS legacy data set now available through ASKAP's new archive facility
The CASDA team are pleased to announce that HIPASS cubes are now available in the CSIRO ASKAP Science Data Archive (CASDA).

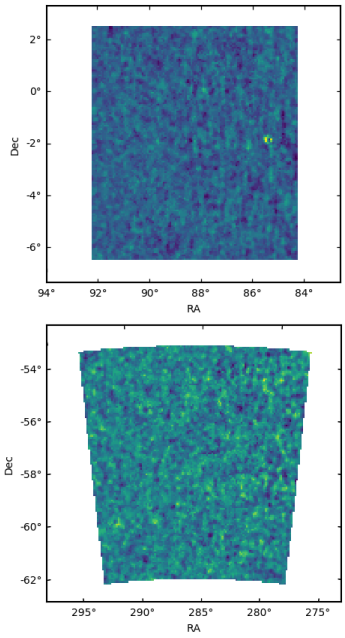
CASDA is a collaboration between CASS, CSIRO IM&T, and the Pawsey Supercomputing Centre, to build a data archive for the Australian Square Kilometre Array Pathfinder (ASKAP). It will provide long term storage for Australian SKA Pathfinder (ASKAP) data products, and serve those to astronomers around the world using both virtual observatory (VO) and web-based portal services.

The `HI Parkes All Sky Survey' (HIPASS) is a legacy dataset of much interest and value to the community. The dataset covers the whole southern sky, and northern declinations to +25 deg. HIPASS was carried out from 1997 to 2002 with the Australia Telescope National Facility's Parkes 64-m telescope.

CASDA provides full cube download, subcube and spectra cutout facilities utilizing the multi-dimensional VO protocols (SIA2, Datalink and SODA). You can access the HIPASS collection at:
https://data.csiro.au/dap/landingpage?pid=csiro:32333
or through CASDA's VO interface. Please refer to the readme file attached to the collection for more detailed information on the HIPASS data in this collection.

More information: https://data.csiro.au/dap/landingpage?pid=csiro:32333

VOSA New Release and Gaia DR2
The Spanish VO released a new version of VOSA (v6.0) in April 2018. VOSA (VO Sed Analyzer) is a web-based tool designed to build observational spectral energy distributions and to estimate physical parameters (Teff, logg,



[M/H], masses, ages, etc) from comparison with models. In the last five years more than 1500 users have analysed five million objects and have published more than 150 refereed papers using VOSA.

New photometric catalogues and collections of theoretical models, new visualization tools and an asynchronous management of the input files to avoid long waits with heavy files are some of the functionalities implemented in this new version.

Special attention deserves to be given to the upgrades made to deal with Gaia DR2 data. Photometric information (G, Bp, Rp magnitudes) converted to fluxes using the SVO Filter Profile Service (http://svo2.cab.inta-csic.es/theory/fps3) as well as parallaxes can now be used in the VOSA workflow.

More information: http://svo2.cab.inta-csic.es/theory/vosa/

SOME RECENT PAPERS ABOUT VO-ENABLED SCIENCE

Featured Science Publication

The Gaia-ESO Survey and CSI 2264: Substructures, disks, and sequential star formation in the young open cluster NGC 2264

Venuti, L.; Prisinzano, L.; Sacco, G. G.; Flaccomio, E.; Bonito, R.; Damiani, F.; Micela, G.; Guarcello, M. G.; Randich, S.; Stauffer, J. R.; Cody, A. M.; Jeffries, R. D.; Alencar, S. H. P.; Alfaro, E. J.; Lanzafame, A. C.; Pancino, E.; Bayo, A.; Carraro, G.; Costado, M. T.; Frasca, A. Jofré, P.; Morbidelli, L.; Sousa, S. G. and Zaggia, S.

Astronomy and Astrophysics (2018) Volume 609, A10

Context. Reconstructing the structure and history of young clusters is pivotal to understanding the mechanisms and timescales of early stellar evolution and planet formation. Recent studies suggest that star clusters often exhibit a hierarchical structure, possibly resulting from several star formation episodes occurring sequentially rather than a monolithic cloud collapse.

Aims: We aim to explore the structure of the open cluster and star-forming region NGC 2264 (3 Myr), which is one of the youngest, richest and most accessible star clusters in the local spiral arm of our Galaxy; we link the spatial distribution of cluster members to other stellar properties such as age and evolutionary stage to probe the star formation history within the region.

Methods: We combined spectroscopic data obtained as part of the Gaia-ESO Survey (GES) with multi-wavelength photometric data from the Coordinated Synoptic Investigation of NGC 2264 (CSI 2264) campaign. We examined a sample of 655 cluster members, with masses between 0.2 and 1.8 M☉ and including both disk-bearing and disk-free young stars. We used Teff estimates from GES and g,r,i photometry from CSI 2264 to derive individual extinction and stellar parameters.

Results: We find a significant age spread of 4-5 Myr among cluster members. Disk-bearing objects are statistically associated with younger isochronal ages than disk-free sources. The cluster has a hierarchical structure, with two main blocks along its latitudinal extension. The northern half develops around the O-type binary star S Mon; the southern half, close to the tip of the Cone Nebula, contains the most embedded regions of NGC 2264, populated mainly by objects with disks and ongoing accretion. The median ages of objects at different locations within the cluster, and the spatial distribution of disked and non-disked sources, suggest that star formation began in the north of the cluster, over 5 Myr ago, and was ignited in its southern region a few Myr later. Star formation is likely still ongoing in the most embedded regions of the cluster, while the outer regions host a widespread population of more evolved objects; these may be the result of an earlier star formation episode followed by outward migration on timescales of a few Myr. We find a detectable lag between the typical age of disk-bearing objects and that of accreting objects in the inner regions of NGC 2264: the first tend to be older than the second, but younger than disk-free sources at similar locations within the cluster. This supports earlier findings that the characteristic timescales of disk accretion are shorter than those of disk dispersal, and smaller than the average age of NGC 2264 (i.e., ≲3 Myr). At the same time, we note that disks in the north of the cluster tend to be shorter-lived (2.5 Myr) than elsewhere; this may reflect the impact of massive stars within the region (notably S Mon), that trigger rapid disk dispersal.

Conclusions: Our results, consistent with earlier studies on NGC 2264 and other young clusters, support the idea of a star formation process that takes place sequentially over a prolonged span in a given region. A complete understanding of the dynamics of formation and evolution of star clusters requires accurate astrometric and kinematic characterization of its population; significant advance in this field is foreseen in the upcoming years thanks to the ongoing Gaia mission, coupled with extensive ground-based surveys like GES.

Refereed Publications

The full list of refereed publications from January to June 2018 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

20-31 August 2018 - XXXth General Assembly of the International Astronomical Union
University of Vienna, Austria
The next IAU General Assembly is taking place in Vienna, Austria and will last for two five-day sessions spread over two weeks. This event is a unique opportunity for astronomers worldwide working in all fields of astronomy to come together. In addition to the core administrative meetings, the General Assembly also includes a substantial and attractive scientific programme. This comprises of seven Symposia, each lasting an average of three days, and fifteen specialized Focus Meetings. In addition, two full days are reserved for Division Meetings, with no overlap with the general program.
The IVOA will be exhibiting at the assembly as well as a number of IVOA member groups. Come to the IVOA booth to talk with the specialists and ask for demonstrations of tools and interfaces!

24-27 September 2018 - .Astronomy X
STScI, Baltimore, USA
The .Astronomy conference series aims to build a dynamic and creative community of scientists and educators to exploit the potential offered by modern computing and the internet in the era of data-driven astronomy. Rather than scientific questions, the focus is on innovative use of the web to develop new research tools, and to communicate with a broad audience through online platforms and innovative engagement resources. .Astronomy provides scientists, developers and science communicators an opportunity to showcase their ideas and skills outside their institutes or research areas, and help them get credit for their work. The conference venue, the Space Telescope Science Institute in Baltimore, is a global centre for space astronomy: the hub of Hubble, and the home of its golden heir, the James Webb Space Telescope. STScI hosts MAST, the Mikulski Archive for Space Telescopes, which makes data available to the community from numerous other missions and projects, such as Kepler, TESS and PanSTARRS. We'll be incorporating the theme of space into our sessions.

8-10 November 2018 - IVOA Interoperability Meeting
College Park, Maryland, USA
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 2018 IVOA Interoperability meeting will be held in College Park, Maryland, USA, and will be hosted by the USVOA.

11-15 November 2018 - ADASS XXVII
College Park, Maryland, USA
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 XXVIII program will include invited talks, contributed papers, display sessions, tutorials, computer demonstrations, and special interest ("Birds of a Feather" or BoF) meetings.

20-22 November 2018 - Fourth ASTERICS Virtual Observatory School
Observatoire Astronomique de Strasbourg, Strasbourg, France
The goal of the Fourth ASTERICS Virtual Observatory School is twofold: Expose European astronomers and representatives of the ESFRI project involved in ASTERICS to the variety of VO tools and services available today so that they can use them efficiently for their own research and gather requirement and feedback from them. To achieve these goals, VO experts will lecture and tutor the participants on the usage of VO tools and services. Real life examples of scientific applications will be given. A large fraction of the time will be dedicated to hands-on exercises, which will allow participants to become fully familiar with the VO capabilities on their own laptops.