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VOExplorer: Visualising Data Discovery in the Virtual Observatory

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Abstract. The UK AstroGrid⁵ project has developed the VOExplorer interface to the VO as part of its forthcoming Desktop suite of applications. VOExplorer offers a powerful data-centric visualisation for browsing and filtering the entire VO registry using an iTunes type interface. We demonstrate how this allows the user to bookmark their own personalised lists of resources and to run tasks on the selected resources as desired. Thus VOExplorer significantly simplifies returning relevant data to queries such as “find me all extended X-ray sources in the 2XMM catalog”, and then export to a new catalogue or “find me all optical, near-IR and X-ray catalogued objects within 0.1 arcmins of a new transient Gamma Ray Burst (GRB) event” and now even “find me all transient events from e.g. GCN, IAU alerts previously recorded for this search radius”. HelioScope similarly searches solar archives within a given time interval. We demonstrate how the user is then offered the opportunity to process and act on those data sets. For this purpose a range of data visualisation and analytical tools are now available to pass data into and between directly. These include TopCat for catalogues, Aladin and Gaia for images, SPLAT and VOSpec for spectra or a simple ADQL query interface for more advanced use cases.

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⁵<http://www.astrogrid.org>

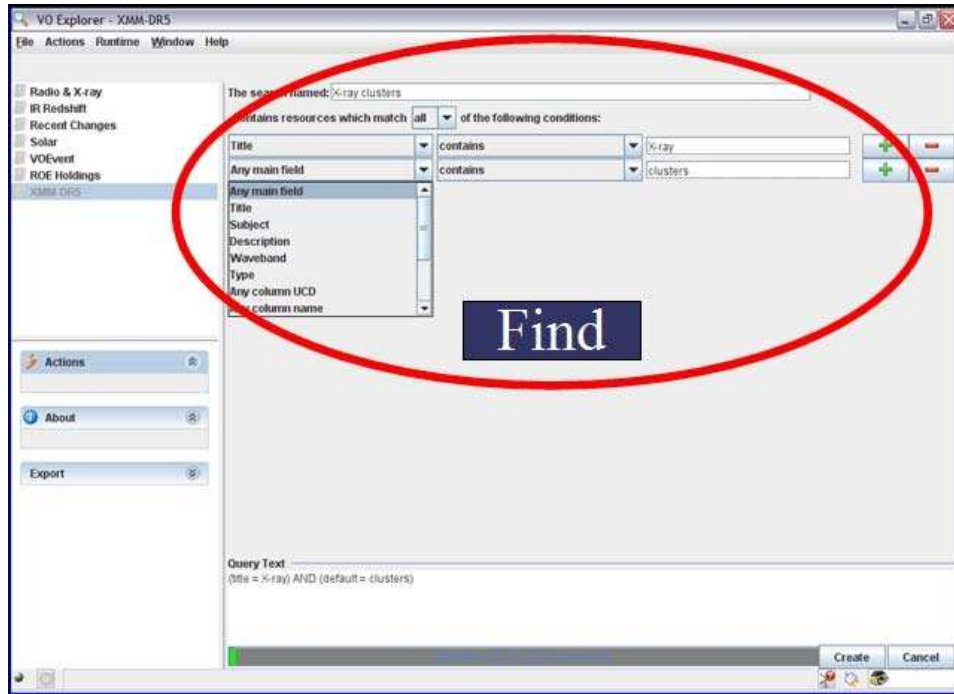


Figure 1. The VOExplorer interface: build a list of VO registered resources matching user defined conditions as shown, e.g. X-ray clusters

1. Introduction

The range and complexity of datasets and resources published to the Virtual Observatory (VO) is rapidly increasing. These resources are heterogeneous - and are published through various standard interfaces allowing access to images, catalogues, spectra, transient event data, tool interfaces and so on.

Providing access to these resources is a success of the Virtual Observatory movement, where effective use of newly emerging publishing standards as provided by the International Virtual Observatory Alliance (IVOA⁶) has been made by the astronomy community. Information about each resource published to the Virtual Observatory is entered into a top level, continually updating “registry”, this providing in effect a record of where and what the resource is.

With the advent of these many resources available through the VO, an emerging challenge is how to offer the astronomer a reliable and usable means to search, retrieve and visualise the relevant data and resources to meet the needs of their particular science problem.

The UK AstroGrid project has now developed the VOExplorer interface to the VO as part of its Desktop suite of applications. In this presentation we briefly outline examples of functionality using a simple science use case.

⁶<http://www.ivoa.net>

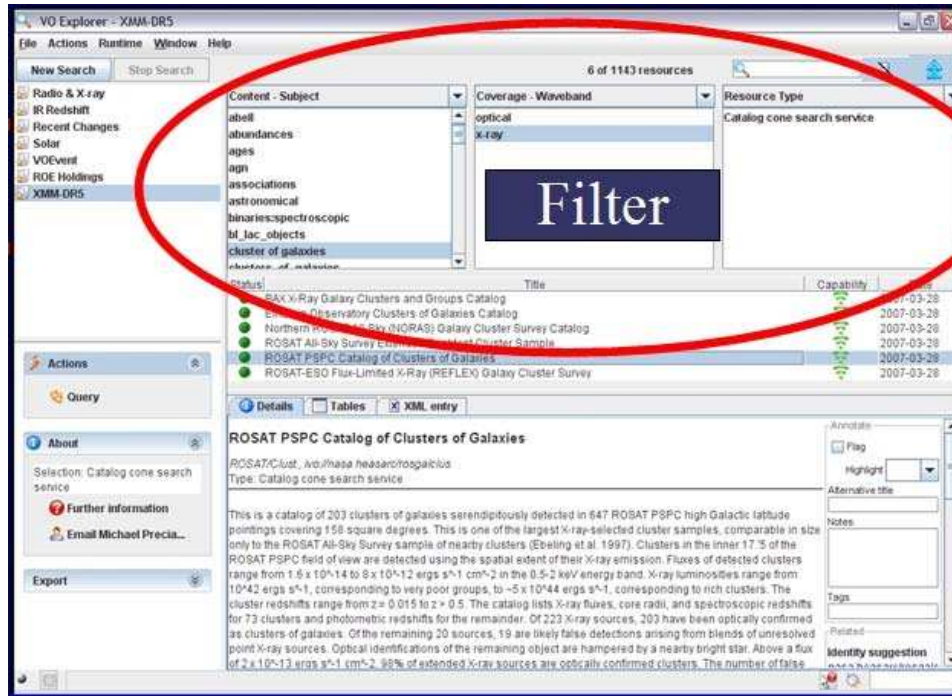


Figure 2. Filter VO resources: apply filter wheels to metadata of the VO resource list such as content, coverage or resource type to refine search and launch e.g. positional search in ROSAT cluster catalogue using AstroScope.

2. The VOExplorer Interface in action: 2XMM clusters of galaxies

VOExplorer offers a powerful data-centric visualisation for browsing and filtering the entire VO registry using an iTunes type interface. This allows you to bookmark your own personalised lists of resources for repeat use, filter using any available metadata and then to run tasks on the selected resources as desired.

In Fig 1 we show a screenshot of the VOExplorer resource search interface which allows a user to build a set of AND, OR conditions. This example is a simple search for resources containing both “X-ray” in the title AND requiring any main field to contain “clusters”. A list of resources is then returned and the search may now be refined further by means of metadata filter wheels such as content, coverage or resource type as shown in Fig 2. Under “Actions” available for the selected resource (cone search interface to the ROSAT cluster catalogue in this case) is a positional search facility which launches the AstroScope tool. Similarly for solar datasets or transient event data one can launch the HelioScope or VOScope tool on selected datasets to search by time interval.

As an example of a more advanced task one can use VOExplorer to identify an ADQL (Astronomical Data Query Language, based on a simple subset of SQL) query interface to the newly released 2XMM⁷ X-ray catalogue available

⁷<http://xmmssc-www.star.le.ac.uk/Catalogue/2XMM/>

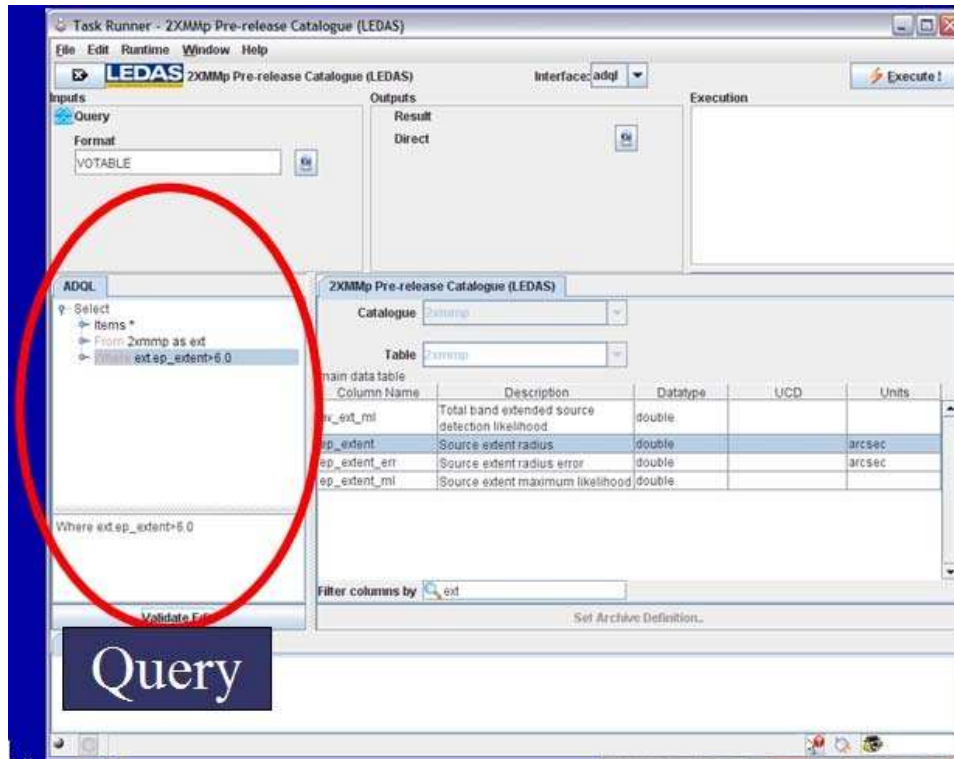


Figure 3. Query science catalogue: select an ADQL query interface to the 2XMM X-ray catalogue using VOExplorer then identify an extent column and extract all extended sources according to user selected value(s) to create science sample in VOTable format for further visualisation and analysis.

in the VO registry via LEDAS⁸ (LEicester Database and Archive Service). The user can then filter the available 2XMM columns for extent parameters and then perform a simple 3-line ADQL query to select and return all extended X-ray sources (column `ep_extent` ≥ 6 arcsecs) in the catalogue to standard VOTable format (Fig 3). More advanced cross matching to other archives and other complex tasks may then be performed using e.g. python scripts from the command line using the AstroGrid Runtime capability and template examples are provided by AstroGrid.

Once a sample is selected the user is offered the opportunity to process and act on those data sets. For this purpose a range of data visualisation and analytical tools are available to pass data into and between directly via the PLASTIC/SAMP messaging protocol. Popular tools include TopCat for catalogues, Aladin and Gaia for images, SPLAT and VOSpec for spectra.

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⁸<http://ledas-www.star.le.ac.uk>