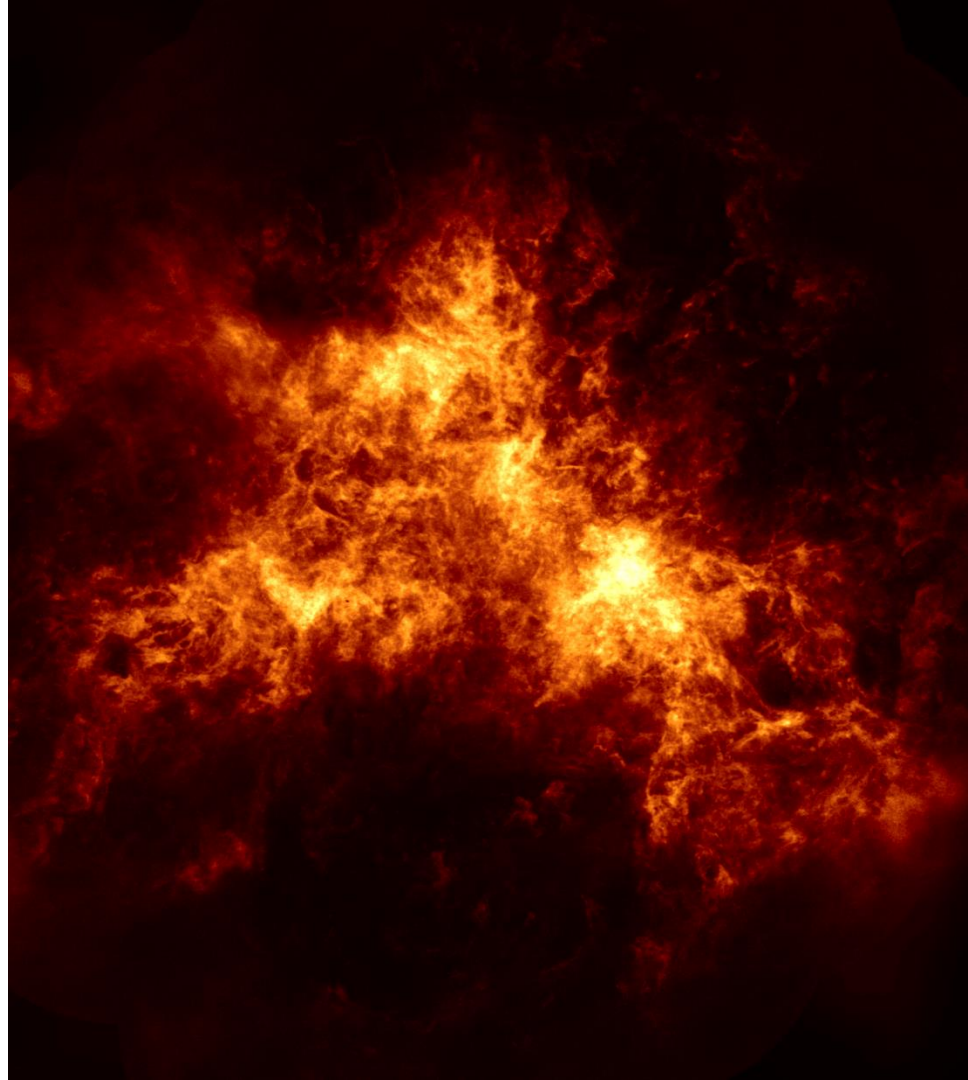




VO Powering the CSIRO ASKAP Science Data Archive

James Dempsey | 5 May 2020





CSIRO ASKAP Science Data Archive

- Archive for Australian Square Kilometre Array Pathfinder (ASKAP)
- Science-ready data products
- Data formats:
 - Images & Image cubes (FITS)
 - Spectra (FITS)
 - Catalogues (VOTable)
 - Visibilities (CASA Measurement Sets)

Credit: CSIRO





Other ASVO Radio Archives

- MWA - Murchison Widefield Array
 - Low frequency array, SKA precursor
 - Raw and calibrated visibility format
- PSRDA – Parkes Pulsar Data Archive
 - Parkes 64-m ‘The Dish’
 - Pulsar data in time series format (PSRFITS)
- ATOA – Australia Telescope Online Archive
 - Australia Telescope Compact Array
 - Spectral line and continuum raw visibility data



VO Protocols in the ASVO Radio Archives

Protocol	ASKAP	MWA	ATOA	PSRDA
TAP – Table Access Protocol	✓	✓	✓	✓
ObsCore	✓	✓	✓	✓
ConeSearch	✓	✓	✓	✓
Datalink	✓			
SIA2 – Simple Image Access	✓			
SSA – Simple Spectral Access	✓			
SODA- Server-side Operations for Data Access	✓			
HiPS	✓			



CASDA Aims



Data Discovery

Find data useful to you

Minimal radio astronomy
knowledge assumed

Query data products

Query source catalogues



Data Access

Download entire data
products

Extract small parts of very
large cubes (~800GB)



Data Publication

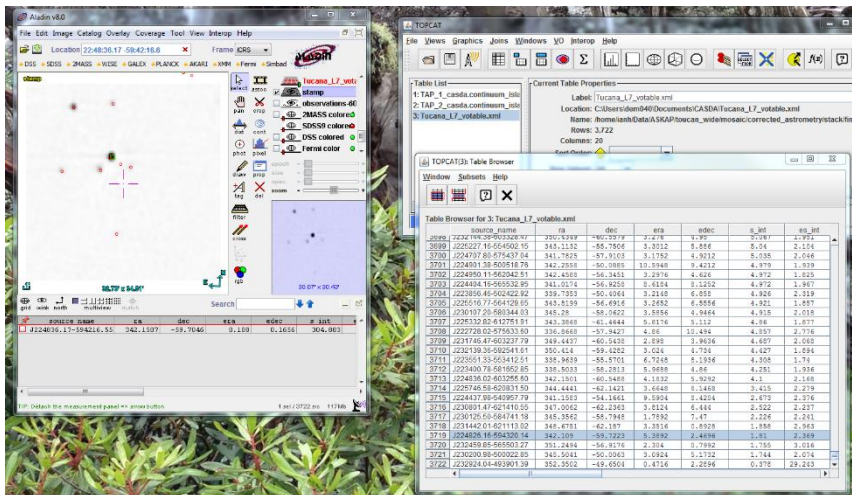
Science team 'value-added'
data

Legacy surveys

DOIs assigned



VO Applications



- Access data directly in
 - TOPCAT
 - Aladin
 - SPLAT-VO



ASKAP Data on DAP

- ASKAP data is served through CSIRO's Data Access Portal
- These web tools also interact with the VO services
- Downloads
- Cutouts
- Spectra generation
- Catalogue queries

CASDA Observation Search

Source name / position Clear form

Position: Single Multiple

Object name: Resolve

Right ascension:

Declination:

Search radius:

Observation / Project

Project:

Filename:

CASDA Image Generation Service

Project ID: A2304

Project name: ASKAP Early Science Broadband Survey

Scheduling block ids: 2338

Image type: cutout (selected) to

File size: 455.3 Mb

Right ascension range: 338.65242 - 339.768291 decimal degrees

Declination range: -49.50287 - -46.788168 decimal degrees

Frequency range: 1380.0 - 1400.0 MHz

Polarisation: //

How to search CASDA data

To display all results just click the button

Enter search parameters

Fill in one or many fields to see CASDA observation results you want

Searches will be performed against data product types by default. You can unselect types in the "Data types" section to increase search accuracy

Filter search results

You can click on the "configure" button to set up the columns for personal view of the results.

The search results will appear on a page. Filter the results by clicking "Options", then the "Filter" result to further refine your search results

Each filter is applied after clicking at the bottom of the "Filter results" dialog. The number of results for each filter is calculated and displayed next to the label.

Instructions:

CASDA provides three methods to generate spatial cutouts or custom spectra from the selected image cube:

1. By providing the J2000 range of values in the RA or Dec fields, and the Frequency values for Image Cubes. To define a single cutout/spectrum.
2. By using the Astwin Line Image, simply click and drag with your mouse to create the data region/region area you wish to create.
3. If this image cube was found using a search based on a file containing multiple sources, these same sources can be used to generate multiple cutout/spectra.

CASDA Skymap Search

Target:

Continuum Component

Continuum Island

Spectral Line Absorption

Spectral Line Emission

Polarisation Component

None

Name	J221426-453317
RA (J2000)	333.60903
Dec (J2000)	-45.554887
Peak Flux	47.257 mJy
Integrated Flux	52.067 mJy
Major Axis	18.7 arcsec
Minor Axis	15.22 arcsec
Position Angle	112.17 degrees



CASDA Astroquery Module

- Python module
- Discover and download data
- Uses:
 - SIA2, DataLink, SODA
- <https://astroquery.readthedocs.io/en/latest/casda/casda.html>

Download a fits image using astroquery.casda

This example script will download a continuum image of the NGC 7232 galaxy group produced from ASKAP scheduling block 2338, part of the WALLABY test observations. It demonstrates the use and features of the CASDA astroquery library.

```
In [ ]: M from astropy import coordinates, units as u, wcs
        from astropy.utils.data import download_files_in_parallel
        from astroquery.casda import Casda
        import getpass
```

First we want to look up the sky location we are interested in. We use the inbuilt SkyCoord lookup to query the CDS name resolver for the sky position.

```
In [ ]: M centre = coordinates.SkyCoord.from_name('NGC 7232')
        centre
```

Next we want to create an instance of the CASDA Astroquery object with our credentials. CASDA requires authentication to access any image products. CASDA uses OPAL credentials. Anyone can register for OPAL at <https://opal.atnf.csiro.au/>. The credentials will not be immediately checked, only held until they are needed.

```
In [ ]: M username = 'james.dempsey@csiro.au'
        password = getpass.getpass(str("Enter your OPAL password: "))
        casda = Casda(username, password)
```

Now we will search for CASDA data products in our area of interest, around NGC 7232. As this uses CASDA's Simple Image Access Protocol (SIAP2) service, it will return all image, cube and spectral data products, but not measurement sets or catalogues.

Note that we do not need to be authenticated to query metadata, so we just use the class rather than the instance with our credentials, although that would also work.

```
In [ ]: M result = Casda.query_region(centre, radius=30*u.arcmin, cache=False)
        result
```

The result is a table with all data products listed. However some of these data products may only be available to the project team as they have not been released yet, so we want to filter those out.



Radio Focussed Work

- SODA
 - Add CHANNEL to allow z axis to be specified in pixels
 - Have been asked to do similar for x, y axes
- ObsCore
 - Xel columns in ObsCore 1.1 very useful
 - s_xel1, s_xel2, t_xel, em_xel, pol_xel
 - May provide redundant frequency, velocity terms
 - One approach to visibilities discussed in Groningen



Thank you

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