

Virtual Observatory tools and services

*Evanthia Hatziminaoglou
EURO-VO Facility Centre Astronomer
ESO-Garching*

VO tools and services

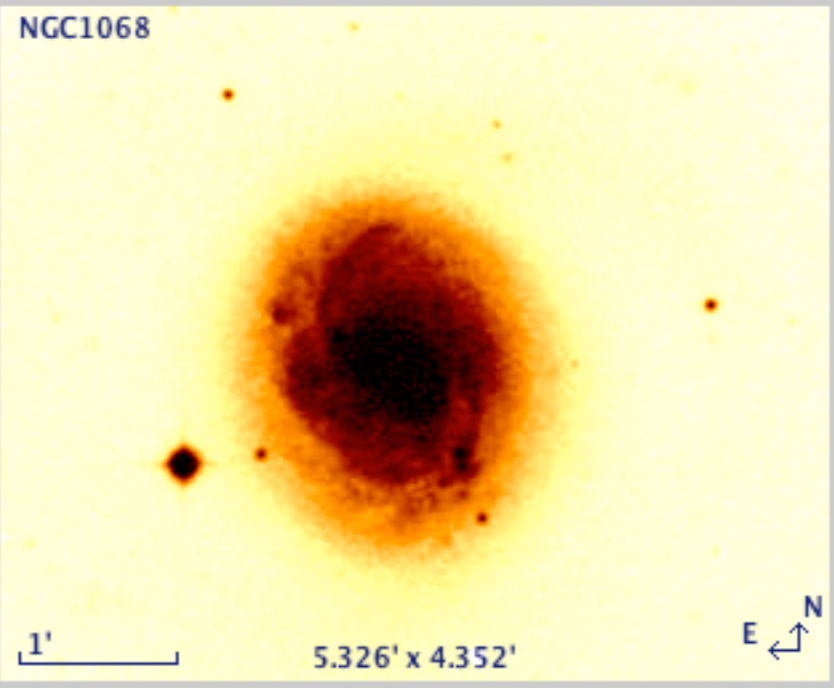
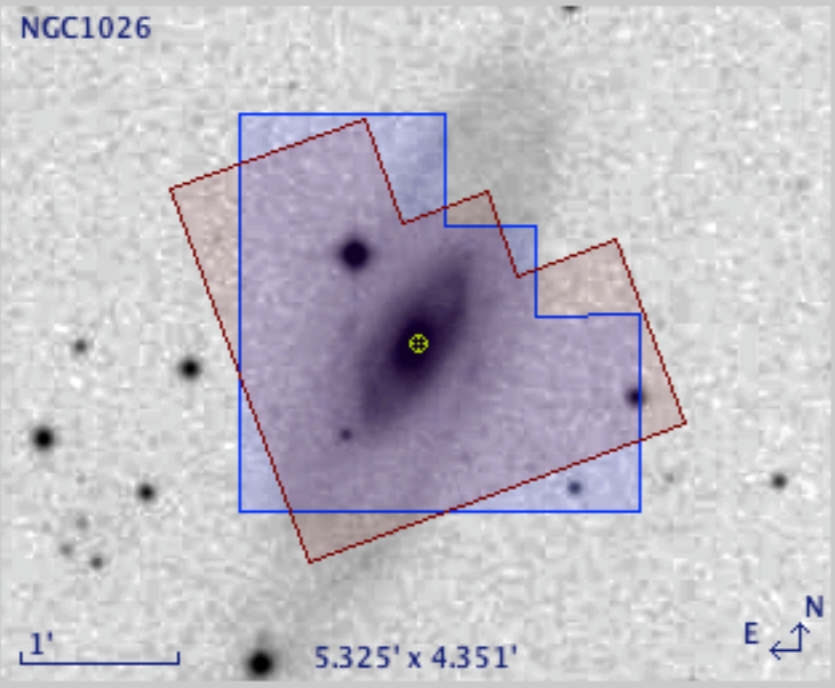
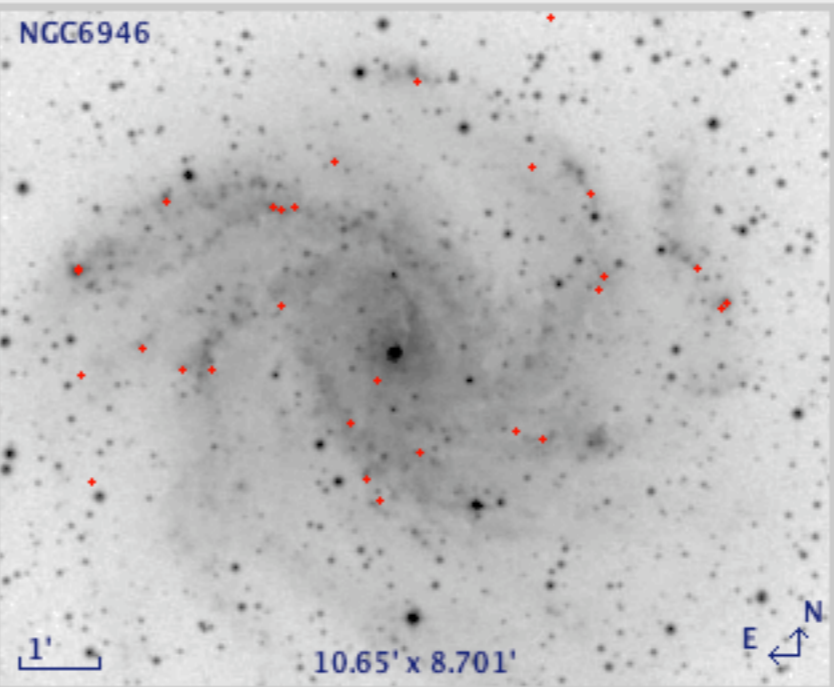
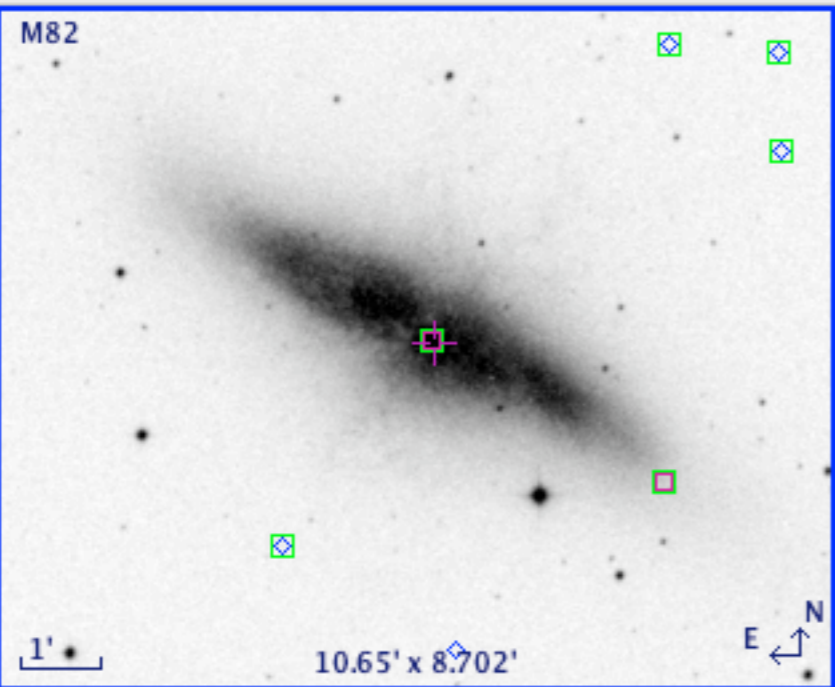


SAMP: a messaging protocol allowing various tools to communicate with each other

VO tools offer a variety of functionalities:
 data discovery / data mining
 cross correlation
 spectra visualisation
 catalogue/table manipulation
 image handling
 plotting

Data Discovery	Spectral Analysis	Data visualisation and handling	SED building and fitting	Cross-correlation	Footprints
Aladin	SPLAT	TOPCAT/STILTS	VOSED	TOPCAT/STILTS	<i>NVO Footprint</i>
VO Desktop	VOSpec	Aladin	VOSA	Aladin	Aladin
<i>Datascope</i>	Specview	VOPlot	<i>easy-z*</i>	<i>Open SkyQuery</i>	VirGO*
Octet	<i>NVO Spectrum</i>	<i>VisIVO</i>	GOSSIP*	VODesktop	
NED	[EURO-3D]	VOCat	<i>NVO Filter</i>		
<i>VoEventNet</i>		<i>Montage</i>	VOSpec		
ASPID		<i>VOSTat</i>			
VirGO*		DS9*			
<i>SkyView</i>		<i>Mirage*</i>			

*existing tool, adapted to “speak” SAMP



M82

- select
- pan
- zoom
- dist
- draw
- tag
- text
- filter
- cross
- rgb
- assoc
- cont
- mqlss
- pixel
- prop
- del

- Chandra
- LEDA
- WFPC2~1
- WFPC2
- HII (Simbad)
- M82
- NGC6946
- NGC1026
- NGC1068

Zoom

12.9' x 12.9'

name	ra	dec	err elli...	err elli...	err elli...	conf flag	extent f...	sat src ...	flux ape...	flux ap
<input type="checkbox"/> CXO J095...	149.0484...	69.6344044	0.61873	0.61874	90.0	F	F	F	1.44124E...	1.73213
<input type="checkbox"/> 2MASXJ09551726+6939...	148.82192	69.65367	-	-	-	-	6.00	6.00	45	
<input type="checkbox"/> CXO J095...	148.7656...	69.72482...	0.47224	0.47224	90.0	F	F	F	2.54349E...	3.06043
<input type="checkbox"/> CXO J095...	148.7718...	69.74516...	0.51303	0.51303	179.9998	F	F	F	3.892E-14	4.453E
<input type="checkbox"/> CXO J095...	148.8370...	69.7452862	0.51413	0.51412	0.0	F	F	F	5.804E-14	6.627E

Server selector

Others File all VO

Image servers

Aladin images

SkyView

Sloan

MAST

CADC

DSS...

VLA...

Others...

VO discovery tool

Target..... NGC1068

Radius..... 3'

Servers Images Catalogs Spectra

Simbad database

Server status report

CADC

Description : Canadian Astronomical Data Center (CADDC)

Type : Image

More info : <http://www.cadc.hia.nrc.gc.ca/cadc/>

Last query : <http://www.cadc-ccda.hia-ih.nrc-cnrc.gc.ca/ivoa/CADC/siapQuery?POS=4>

Status : Ok

Identifier : CADC

The Canadian Virtual Observatory (CVO) provides this SIA server access for some CADDC archives (decompose mosaic images into single extension FITS files, cutout of the region-of-interest when it is smaller than the image, WCS correction of returned FITS files).

More info... Close

Check/uncheck the servers concerned by the ALL VO discovery mode

Select all Unselect all Filter: Go

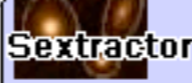
Image servers

1)	<input checked="" type="checkbox"/>	The Aladin image server (CDS/Strasbourg) - DSS/MAM...	Ok	?
2)	<input checked="" type="checkbox"/>	SDSS DR7 images	Ok	?
3)	<input checked="" type="checkbox"/>	Multimission Archive at STScI (MAST)	Ok	?
4)	<input checked="" type="checkbox"/>	Canadian Astronomical Data Center (CADDC)	Ok	?
5)	<input checked="" type="checkbox"/>	Hubble press release images	No result	?
6)	<input checked="" type="checkbox"/>	MAMA ESO R Atlas - VO-Paris (Fr)	Ok	?
7)	<input checked="" type="checkbox"/>	Chandra X-Ray Observatory Data Archive	Ok	?
8)	<input checked="" type="checkbox"/>	NOAO Science Archive	No result	?
9)	<input checked="" type="checkbox"/>	SAI Supernova light curve catalogue	Ok	?
10)	<input checked="" type="checkbox"/>	Observations of neutron stars	Ok	?
11)	<input checked="" type="checkbox"/>	IA2 Italian Center for Astronomical Archive: TNG	Querying.....	?
12)	<input checked="" type="checkbox"/>	VO-Paris MAMA ESO R Atlas	No result	?
13)	<input checked="" type="checkbox"/>	HST-ACS GOODS data within Chandra Deep Field South (CD...	No result	?
		Primary Simple Image Access	Error	?
		NOAO ELAIS N1 -- R	No result	?
		NOAO Extragalactic -- R	No result	?
		Extragalactic Survey	No result	?
		... preview images	Querying.....	?
		...ncillary VLA Data	No result	?
		...rvice	Ok	?
		...ase Image Data Atlas	Ok	?
			Ok	?
			Ok	?

SUBMIT Close



Others



S-extractor facility (v2.5.0)

Catalog servers



Image servers

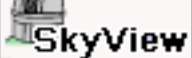


Image reference --- no input ---

Threshold (x RMS) 2.0

Mag zero point

Saturation (ADU)

Astronomical calibration

Choose a calibration method, fill up the corresponding form according to the plane "2MASS.K.981004S_KI0680009"

Label: Mv projection 1

Catalog Cross-match tool

Positional cross-match Cross-ID Ellipses

Positional cross-match

Only positional offset is used to find the matches.

2MASS All-Sky Extended Source Catalog: 3 objects RA ra DEC dec

SuperCOSMOS catalog (SSS.cat): 2212 objects RA ra DEC dec

Threshold is the source separation in arcsec

0 <= threshold <= 4

Choose match method

- Best matches
- All matches
- Sources without match

Advanced options Perform cross-match Close

<input type="checkbox"/>	001060	40.7031830	-0.0202861	1982.779	0.9999E+09	0.9999E+09	0.9999E+09	0.9999E+09	21.052	99.999	99.999
<input type="checkbox"/>	001081	40.6917537	-0.0169997	1982.779	0.3477E+01	0.1843E+03	0.7394E+02	0.7411E+02	19.327	99.999	99.999

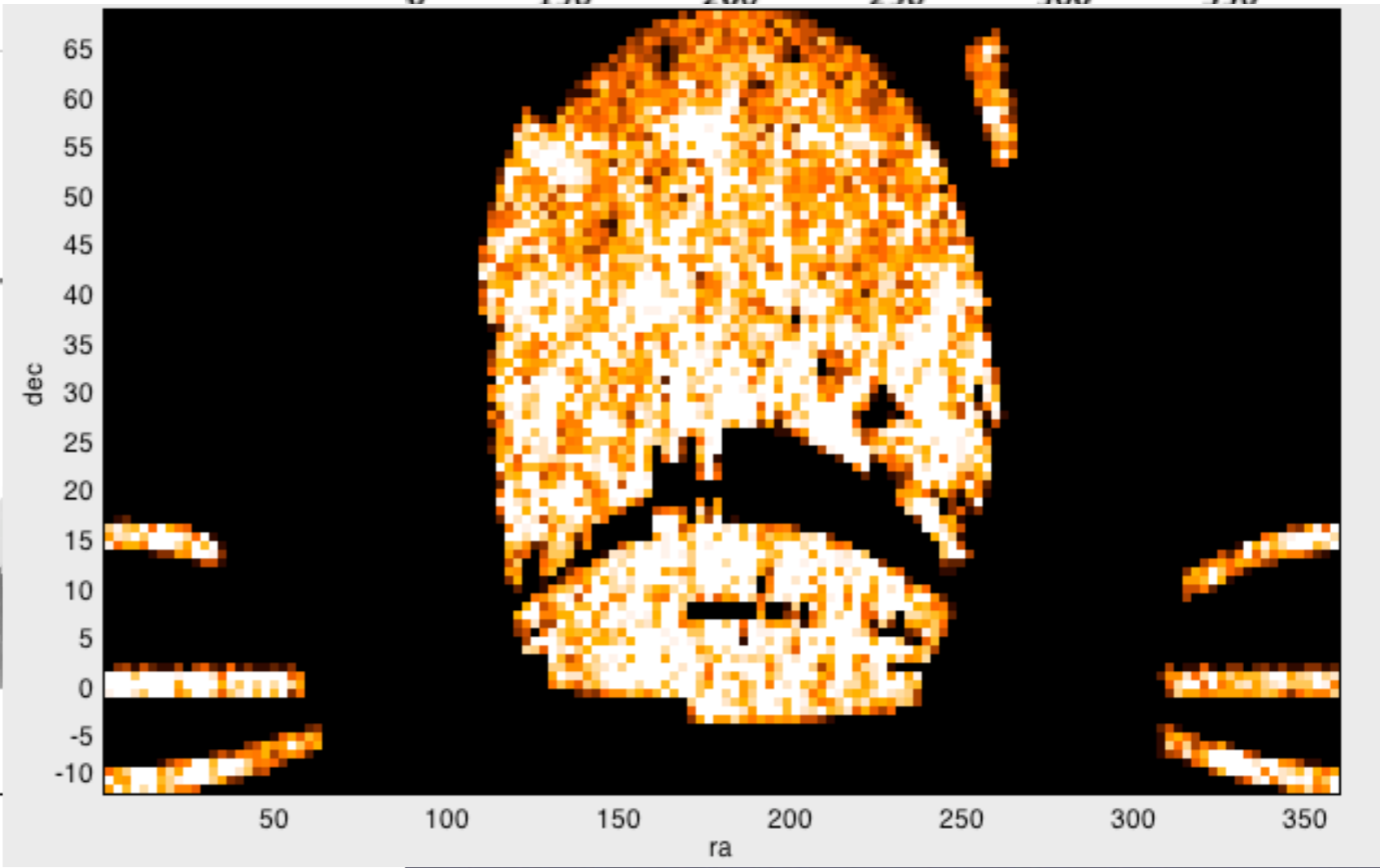
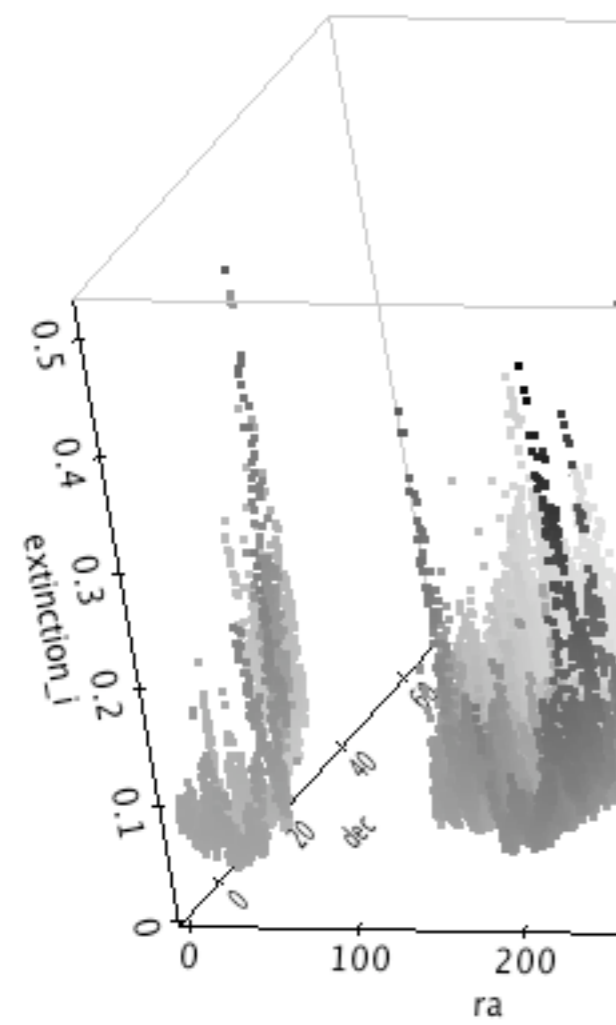
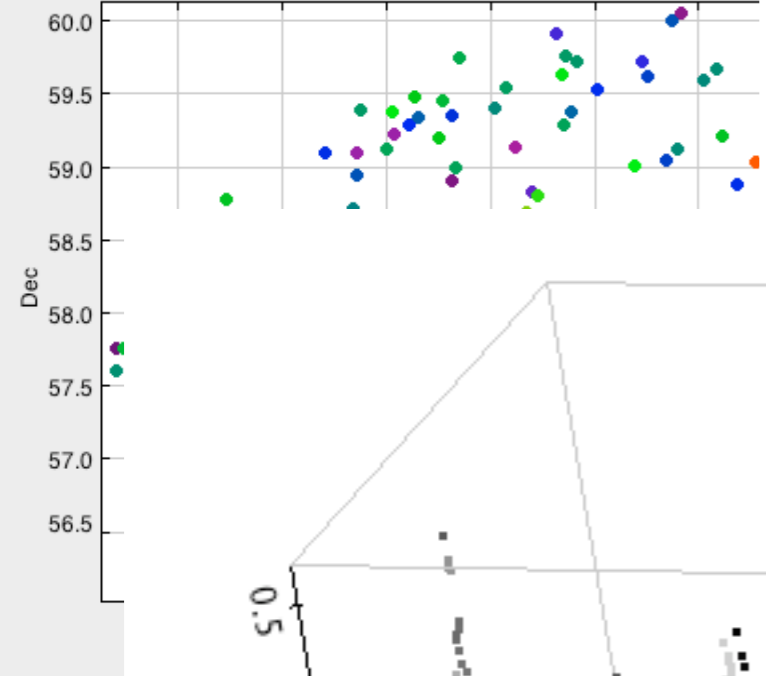
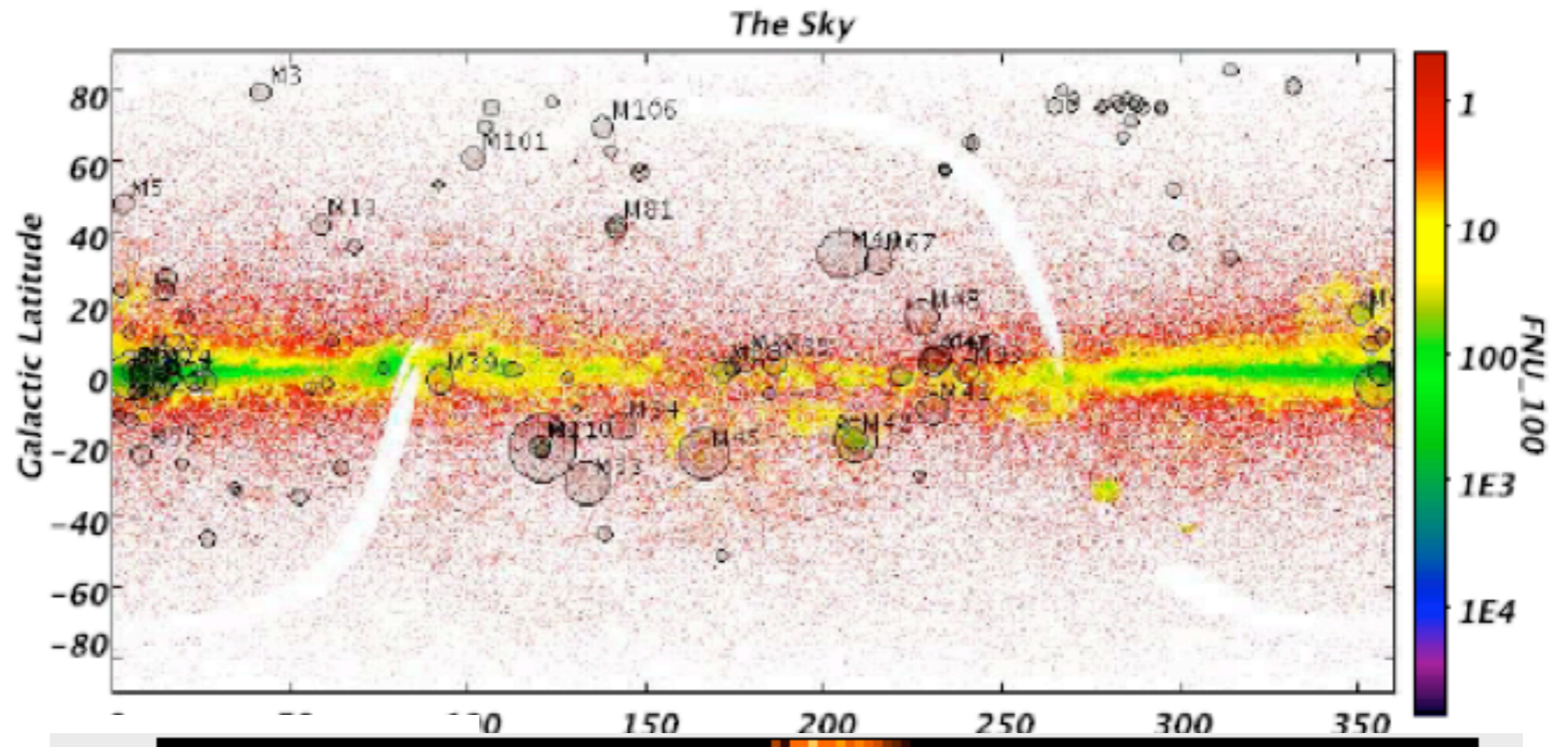
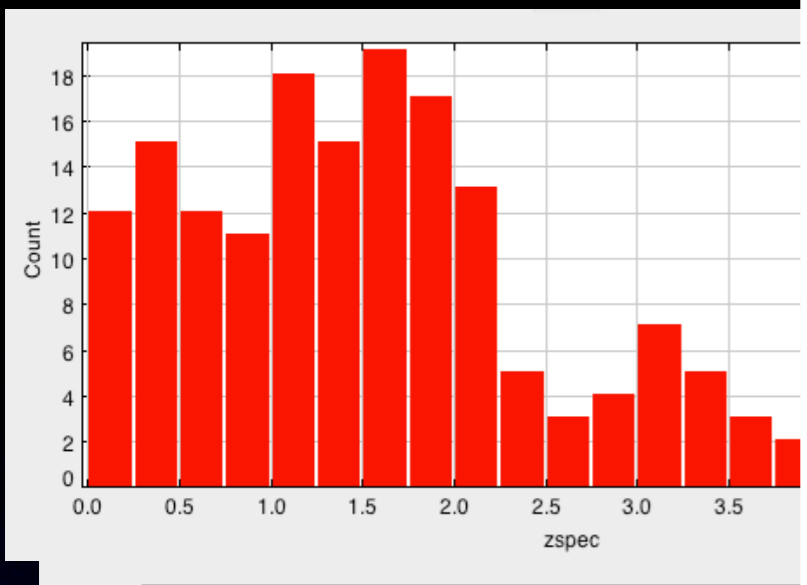
TOPCAT/STILTS - the table 'wizard'

The screenshot displays the TOPCAT software interface with several windows open:

- Table List:** Lists two tables: 1: Lockman_old_sample.dat and 2: lh-swire_sdp090.fits.
- Current Table Properties:** Shows the label 'test.txt'.
- Load New Table:** A window for loading a new table, currently empty.
- TOPCAT(1): Table Browser:** Displays a table browser for 'Lockman_old_sample.dat' with columns: ObjID, RA, Dec, zspec. The first 18 rows are visible.
- TOPCAT(1): Table Parameters:** Shows parameters for 'Lockman_old_sample.dat':

Name	Value	Description
Name	/Users/ehatzimi/Desktop/Lockman_old_sample.dat	Table name
URL	file:/Users/ehatzimi/Desktop/Lockman_old_sample.dat	URL of original table
Column Count	44	Number of columns
Row Count	165	Number of rows
- TOPCAT(1): Table Columns:** A window for managing table columns for 'Lockman_old_sample.dat'. It lists columns with their IDs and visibility status.

Visible	Name	\$ID
<input type="checkbox"/>	Index	\$0
<input checked="" type="checkbox"/>	ObjID	\$1
<input checked="" type="checkbox"/>	RA	\$2
<input checked="" type="checkbox"/>	Dec	\$3
<input checked="" type="checkbox"/>	zspec	\$4
<input checked="" type="checkbox"/>	flux_fuv	\$5
<input checked="" type="checkbox"/>	flux_nuv	\$6
<input checked="" type="checkbox"/>	flux_u	\$7
<input checked="" type="checkbox"/>	flux_g	\$8
<input checked="" type="checkbox"/>	flux_r	\$9
<input checked="" type="checkbox"/>	flux_i	\$10
<input checked="" type="checkbox"/>	flux_z	\$11
<input checked="" type="checkbox"/>	flux_j	\$12
<input checked="" type="checkbox"/>	flux_h	\$13
<input checked="" type="checkbox"/>	flux_k	\$14
<input checked="" type="checkbox"/>	flux_irac1	\$15
<input checked="" type="checkbox"/>	flux_irac2	\$16
<input checked="" type="checkbox"/>	flux_irac3	\$17





Match Criteria

Algorithm:

Max Error:

Exact Valu

1-d Cartes

2-d Cartes

2-d Cartes

3-d Cartes



Available Cone Search Services

Registry:

Keywords:

name	title
ROSAT	ROSAT All-Sky Survey and SDSS Sample of X-Ray Emitting Stars
SDSS	Sloan Digital Sky Survey Quasar Catalog (5th Data Release)
SDSS	Sloan Digital Sky Survey Broad Absorption Line Quasars Catalog: 5th Data Release
SDSS	Sloan Digital Sky Survey Broad Absorption Line Quasars Catalog (3rd Data Release)
QSO	Sloan Digital Sky Survey Quasars Detected by Chandra
KDE	SDSS NBCKDE Catalog of Photometrically Selected Quasar Candidates
...	...

AccessURL	Description	Version
http://heasarc.gsfc.nasa.gov/...		

Multiple Cone Search Parameters

Cone Search URL:

Input Table:

RA column: (J2000)

Dec column: (J2000)

Search Radius column:

Output Mode:

Parallelism: Error Handling:

Table 1

Table:

RA column:

Dec column:

Table 2

Table:

RA column:

Dec column:

Output Rows

Match Selection:

Join Type:

1 or 2

All from 2

1 not 2

2 not 1

1 xor 2

Locating inter-table pairs...

Eliminating multiple rows...

Elapsed time for 1 x 0 s

Match succeeded

- Cone Search
- SIA Query
- SSA Query
- VizieR Catalogue Service
- GAVO Millennium Run Query
- Multicone
- Multiple SIA
- Multiple SSA

VOSpec, SPLAT, Specview - the spectral analysis tools

The image displays the VOSpec web interface, which is used for spectral analysis. It is divided into several sections:

- Server Selector:** A panel on the left titled "Query by Service" with a green status message: "Green services are online and support params selected". It lists various astronomical services, with "ESO Spectrum Service" checked. Below this is a "Query Outlook" section with buttons for "Refresh", "Add SSA/TSA", and "Select All SSA".
- Query by params:** A central panel titled "Query" with a "Tree" button. It shows the target "Vega" with coordinates (Ra: 279.234735, Dec: 38.78369194) and size 1. The "Wave Unit" is set to "Angstrom" and "Log" is checked. The "Flux Unit" is "erg/cm2/s/A". Other parameters include "RedShift: 0.00", "De-reddening", and " λV : 0.00".
- Graphic Mode:** A vertical list of options for plotting data as "Dots" or "Points" in various colors (red, green, blue, black, yellow, orange, brown, grey).
- Spectral Analysis Tool:** A large plot showing "Flux (erg/cm2/s/A, logarithmic)" on the y-axis (ranging from 1e-17 to 1e-08) versus "Wavelength (Angstrom, logarithmic)" on the x-axis (ranging from 2.0 to 1e06). The plot displays a spectrum with a blue line representing the model fit and various colored dots representing data points. A secondary plot on the right shows a zoomed-in view of the data points.
- Spectra List:** A panel at the bottom showing a list of "Kurucz ODFNEW /NOVER models" for "Synthetic photometry for Kurucz models". Several models are checked, including those with effective temperatures of 9250, 9500, and 9750 K.

At the bottom of the interface, there are buttons for "Virtual Dimension", "RETRIEVE", "Unmark All", and "Reset". The status bar shows "(5.302E4 , 1.44E-13)" and "6 finished".

SPLAT-VO and Specview offer similar data access and similar analysis functionalities

Scripting

e.g.



```
1 # Import some functions
2 from astrogrid import ConeSearch
3 from astrogrid import sesame
4
5 # Query name resolver and get coordinates
6 s=sesame()
7 coords, ra, dec = s.resolve('M51')
8
9 # We are going to query the NED database
10 cone = ConeSearch("ivo://ned.ipac.caltech.edu/BasicData/NED/NEDPosition")
11
12 # Perform the query
13 vot = cone.execute(ra, dec)
14
15 # Print the result
16 print vot
17
18 # or save it
19 open('result.vot', 'w').w
```

COMPLETE EXAMPLES

The following links provide complete scripts which perform the described action. You can copy paste from the pages or download all the scripts from the tar file linked at the bottom.

- [Search a catalogue for sources in a number of positions](#)
- [Search a catalogue for sources in a number of positions \(parallel version\)](#)
- [Search for images covering selected objects or areas](#)
- [Cross Match tables \(NED, 2MASS, SDSS, UKIDSS\)](#)
- [Submit an ADQL query to UKIDSS DR1](#)
- [Cross Match two tables returned by ADQL queries \(IPHAS + 2MASS\)](#)
- [Convert between file formats \(eg. VOTABLE to FITS\)](#)
- [Extract objects from images using SExtractor](#)

These and other Python scripts are available as a tar file: [python.tar.gz](#).

- [ColourCutter: Crossmatch catalogue data selected by colour \(FIR to optical\)](#)

<http://www.astrogrid.org/wiki/Help/IntroScripting/AstrogridPython>

but also:

Aladin macros
STILTS

How to find VO tools

The EURO-VO projects: [VOTECH](#) [EuroVO-DCA](#) [EuroVO-AIDA](#)

Science

- Software**
- Scientific Tutorials
- AIDA Research Initiative
- Scientific Papers
- Science Advisory Committee
- EURO-VO Mailing List
- Acknowledging
- Helpdesk

VO Software

In this section, scientists can find available VO-compatible applications for their immediate use to do science. The level of maturity of the applications depends on a high degree on the level of maturity of the corresponding IVOA protocols and standards, and care must be taken when using them for publications. As a consequence of the flexibility of the standards, several of the applications might overlap in functionality.

Latest Releases: [Datscope v3.2](#) (8 April 2010) [TOPCAT v3.5-2](#) (24 March 2010), [STILTS v2.1-2](#) (24 March 2010), [VODesktop v1.3.2](#) (10 February 2010)

Mailing list for TOPCAT and friends

Application / Version (in alphabetical order)	Functionality	Other VO-compliant tools
Aladin v6.011a (January 2010)	Search for Images: Aladin, Datscope, SkyView, VODesktop	DS9 : Image visualisation
Datscope v3.2 (April 2010)	Search for Spectra: Aladin, Datscope, SPLAT, Specview, VOServices, VOSpec	GOSSIP : SED fitting
Montage	Search for Catalogues: Aladin, Datscope, TOPCAT, VODesktop	Image : Table visualisation
Octet	Image visualisation: Aladin, SkyView	VirGO : Search for Images and Spectra
Open SkyQuery	Spectra visualisation: SPLAT, Specview, VOServices, VOSpec	Browse the Registries
SkyView	Catalogues visualisation: Aladin, TOPCAT, VOPlot	EURO-VO Registry
Specview 2.14.4 (June 2009)	Cross-correlation: Aladin, Open SkyQuery, STILTS, TOPCAT	AstroGrid Registry
SPLAT 3.9.0 (May 2009)	Scatter, 3D plots and histograms: TOPCAT, VOPlot	NVO Registry
TOPCAT/STILTS 3.5-2/2.1-2 (March 2010/March 2010)		Manuals, Tutorials, How-tos
VisIVO 1.5.7.1 (May 2009)		Aladin User manual
VOConvert 1.0 (June 2006)		Datscope how to

[Montage help](#)

[Open SkyQuery help](#)

[SkyView documentation](#)

Science

Software

Scientific Tutorials

AIDA Research Initiative

Scientific Papers

Science Advisory Committee

EURO-VO Mailing List

Acknowledging

Helpdesk

EURO-VO pages: <http://www.euro-vo.org/pub/fc/software.html>