Virtual Observatory tools and services

Evanthia Hatziminaoglou
EURO-VO Facility Centre Astronomer
ESO-Garching

VO tools and services

VO tools offer a variety of functionalities:

- data discovery / data mining
- cross correlation
- spectra visualisation
- catalogue/table manipulation
- image handling
- plotting

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

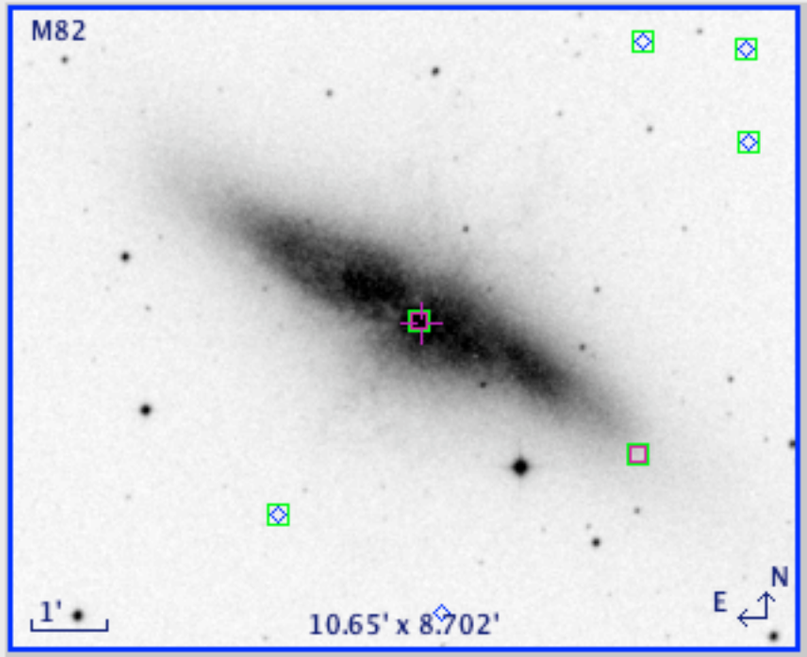
Data Discovery	Spectral Analysis	Data visualisation and handling	SED building and fitting	Cross-correlation	Footprints
Aladin	SPLAT	TOPCAT/STILTS	VOSED	TOPCAT/STILTS	*NVO Footprint*
VO Desktop	VOSpec	Aladin	VOSA	Aladin	Aladin
Datascope	Specview	VOPlot	easy-z*	*Open SkyQuery*	VirGO*
Octet	*NVO Spectrum*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

*existing tool, adapted to "speak" SAMP

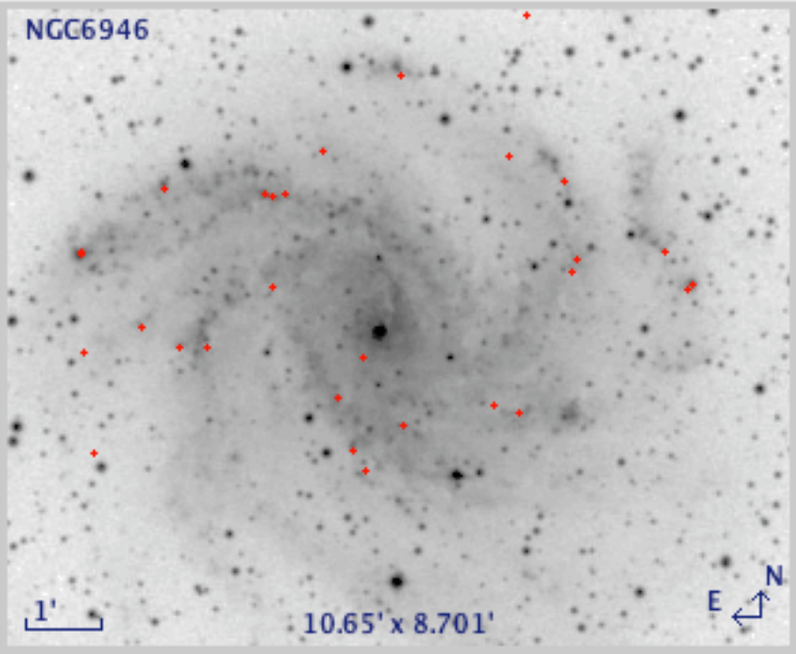
Aladin v6.0

Location | ICRS | Pixel unknown | full

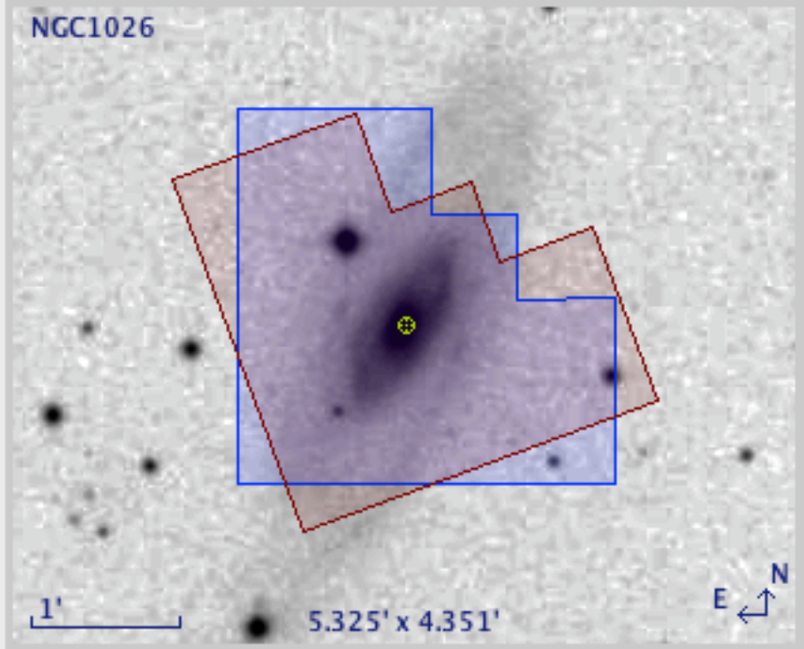
M82



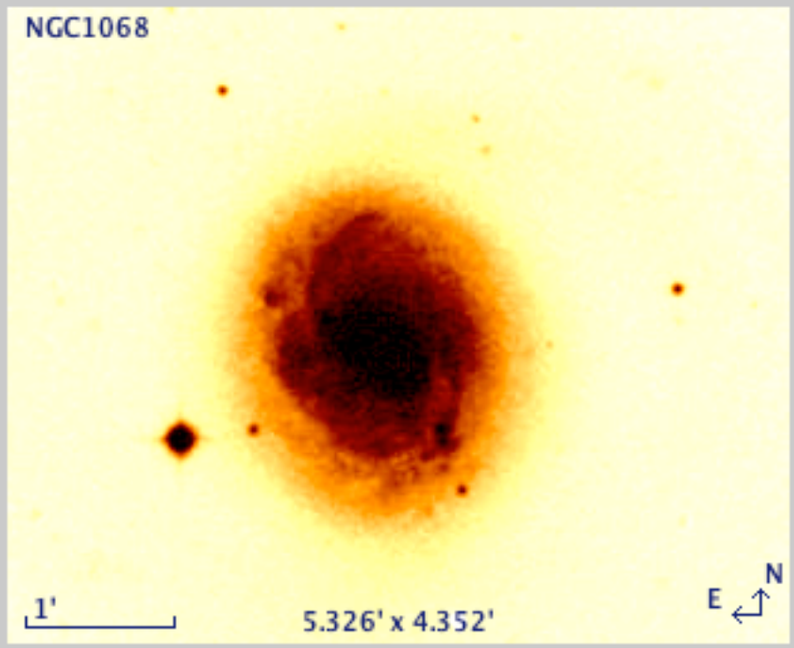
NGC6946



NGC1026



NGC1068

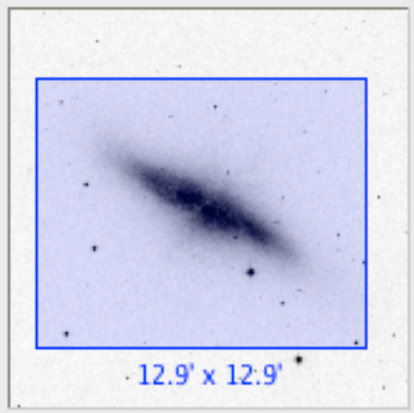


select | pan | zoom | dist | draw | tag | text | filter | cross | rgb | assoc | cont | mglss | pixel | prop | del

M82

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

Zoom 1/2x



grid | multiview | match

[View A1] - M82

Search GO

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

6 sel / 748 src 56Mb

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

Select all | Unselect all | Filter: | Go

Image servers

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

SUBMIT | Close

Server selector

Others | File | all VO

Image servers

Aladin images | SkyView | Sloan | MAST | CADC | DSS... | VLA... | Others...

VO discovery to

Target..... NGC1068

Radius..... 3'

Servers | Images | Catalogs | Spectr

Simbad database

Server status report

CADC

```
Description    : Canadian Astronomical Data Center (CADC)
Type           : Image
More info      : http://www.cadc.hia.nrc.gc.ca/cadc/
Last query     : http://www.cadc-ccda.hia-iha.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 CADC
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

Aladin v6.0

Server selector

full

Others

File | all VO | FOV | Sextractor

Image servers

Catalog servers

select

pan

Aladin images

SkyView

S-extractor facility (v2.5.0)

Image reference ..... --- no input ---

Threshold (x RMS) 2.0

Mag zero point .....

Saturation (ADU) .....

Astronometrical calibration

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

Label: My 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

- [x] Best matches
- [ ] All matches
- [ ] Sources without match

Advanced options | **Perform cross-match** | Close

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
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

89 sel / 2215 src 38Mb

TOPCAT/STILTS - the table 'wizard'

TOPCAT

Table List

1: Lockman_old_sample.dat

2: lh-swire_sdp090.fits

Current Table Properties

Label: test.txt

Load New Table

TOPCAT(1): Table Browser

Table Browser for 1: Lockman_old_sample.dat

	ObjID	RA	Dec	zspec
1	11014.	164.27254	58.07709	0.1
2	9802.			
3	10089.			
4	4483.			
5	12259.			
6	20416.			
7	5549.			
8	23266.			
9	29454.			
10	17415.			
11	7801.			
12	20645.			
13	17499.			
14	27261.			
15	38866.			
16	37569.			
17	28959.			
18	39703.			

TOPCAT(1): Tabl

Table Columns for 1: Lockman_old_sam

	Visible	Name	$ID
0	☐	Index	$0
1	☑	ObjID	$1
2	☑	RA	$2
3	☑	Dec	$3
4	☑	zspec	$4
5	☑	flux_fuv	$5
6	☑	flux_nuv	$6
7	☑	flux_u	$7
8	☑	flux_g	$8
9	☑	flux_r	$9
10	☑	flux_i	$10
11	☑	flux_z	$11
12	☑	flux_j	$12
13	☑	flux_h	$13
14	☑	flux_k	$14
15	☑	flux_irac1	$15
16	☑	flux_irac2	$16
17	☑	flux_irac3	$17

TOPCAT(1): Table Parameters

Table Parameters for 1: 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

Name:

Class:

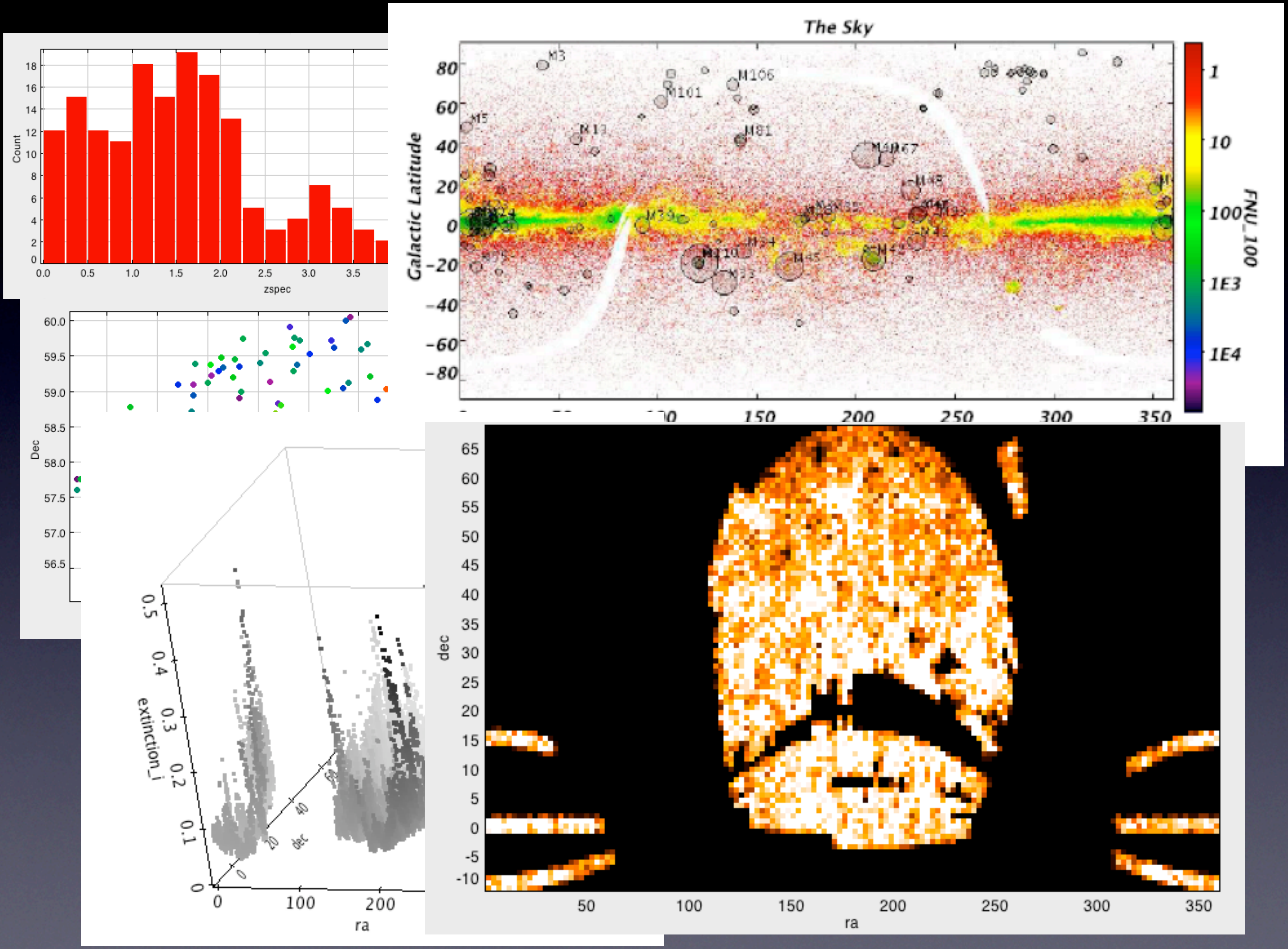
Shape:

Units:

Description:

UCD:

Value:



Count
zspec
Dec
The Sky
Galactic Latitude
FNU_100
M3
M106
M101
M5
M13
M81
M45
M33
extinction_i
dec
ra

Multiple Cone Search

Match Criteria

Algorithm: Sky

Max Error:

- ✓ Sky
- Sky with E
- Sky 3D
- Exact Valu
- 1-d Cartes
- 2-d Cartes
- 2-d Cartes
- 3-d Cartes

Table 1

Table: 1: Lockman_o

RA column: RA

Dec column: Dec

Table 2

Table: 2: lh-swire_sd

RA column: RA

Dec column: DEC

Output Rows

Match Se

Join Type:

- 1 and 2
- 1 or 2
- ✓ All from 1
- All from 2
- 1 not 2
- 2 not 1
- 1 xor 2

Locating inte
Eliminating m
Elapsed time
Match succeeded

Go

Available Cone Search Services

Registry: http://registry.astrogrid.org/astrogrid-registry/services/RegistryQueryv1_0

Keywords: SDSS quasars

And

Cancel Query

Submit Query

ame	title
TAR	ROSAT All-Sky Survey and SDSS Sample of X-Ray Emitting Stars
)	Sloan Digital Sky Survey Quasar Catalog (5th Data Release)
QS2	Sloan Digital Sky Survey Broad Absorption Line Quasars Catalog: 5th Data
QSO	Sloan Digital Sky Survey Broad Absorption Line Quasars Catalog (3rd Data
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/...		

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

Multiple Cone Search Parameters

Cone Search URL: http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet.pl?ta

Input Table: 1: Lockman_old_sample.dat

RA column: RA degrees (J2000)

Dec column: Dec degrees (J2000)

Search Radius column: 1.0 arcsec

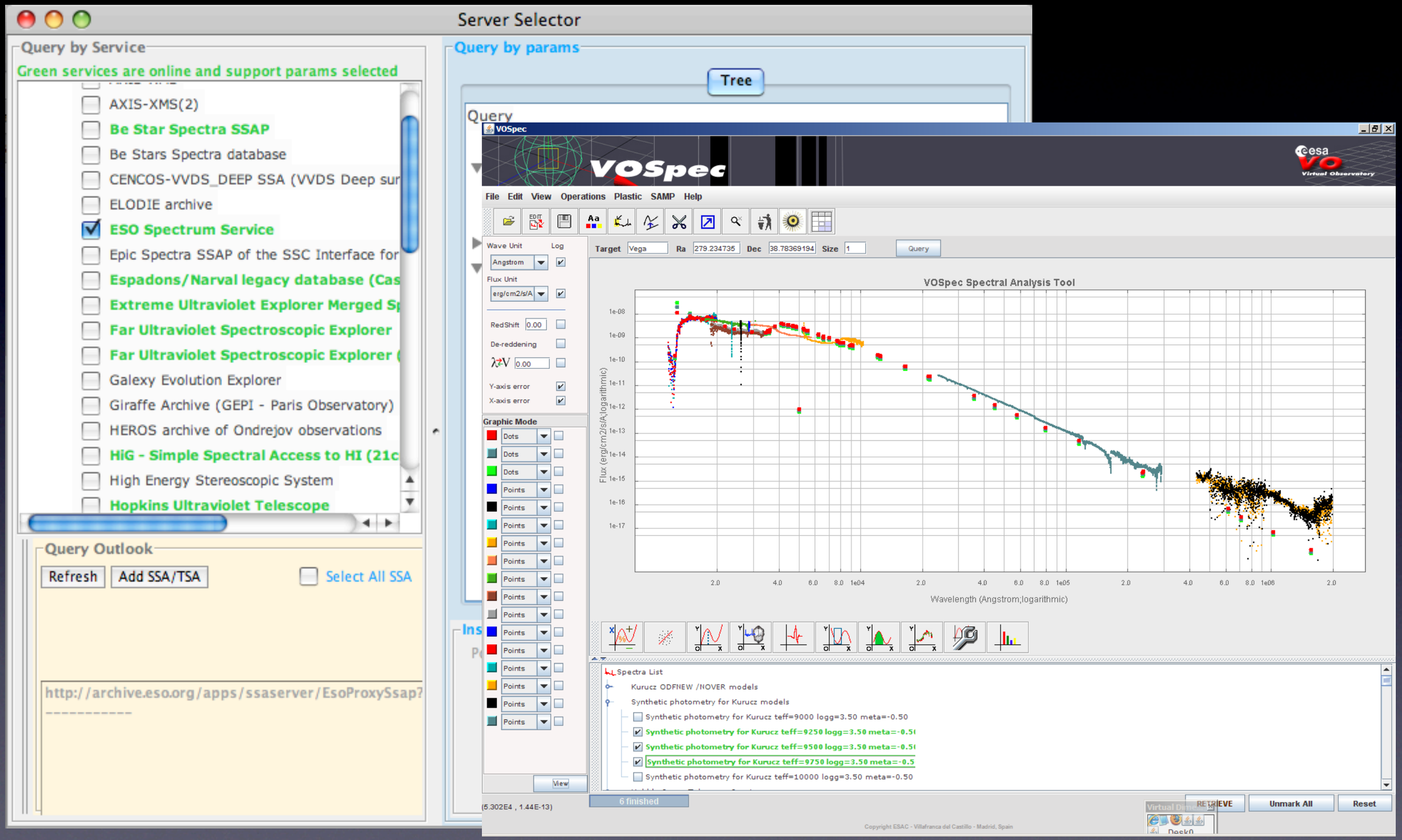
Output Mode: New joined table with best matches

Parallelism: 5 Error Handling: ignore

Go

Stop

VOSpec, SPLAT, Specview - the spectral analysis tools



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

Scripting

e.g. Astro Grid

untitled

```
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://
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
```

Line: 1 Column: 1 Python Tab Size: 4

Complete Examples

The following links provide complete scripts which perform the described action. You can copy paste form 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

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