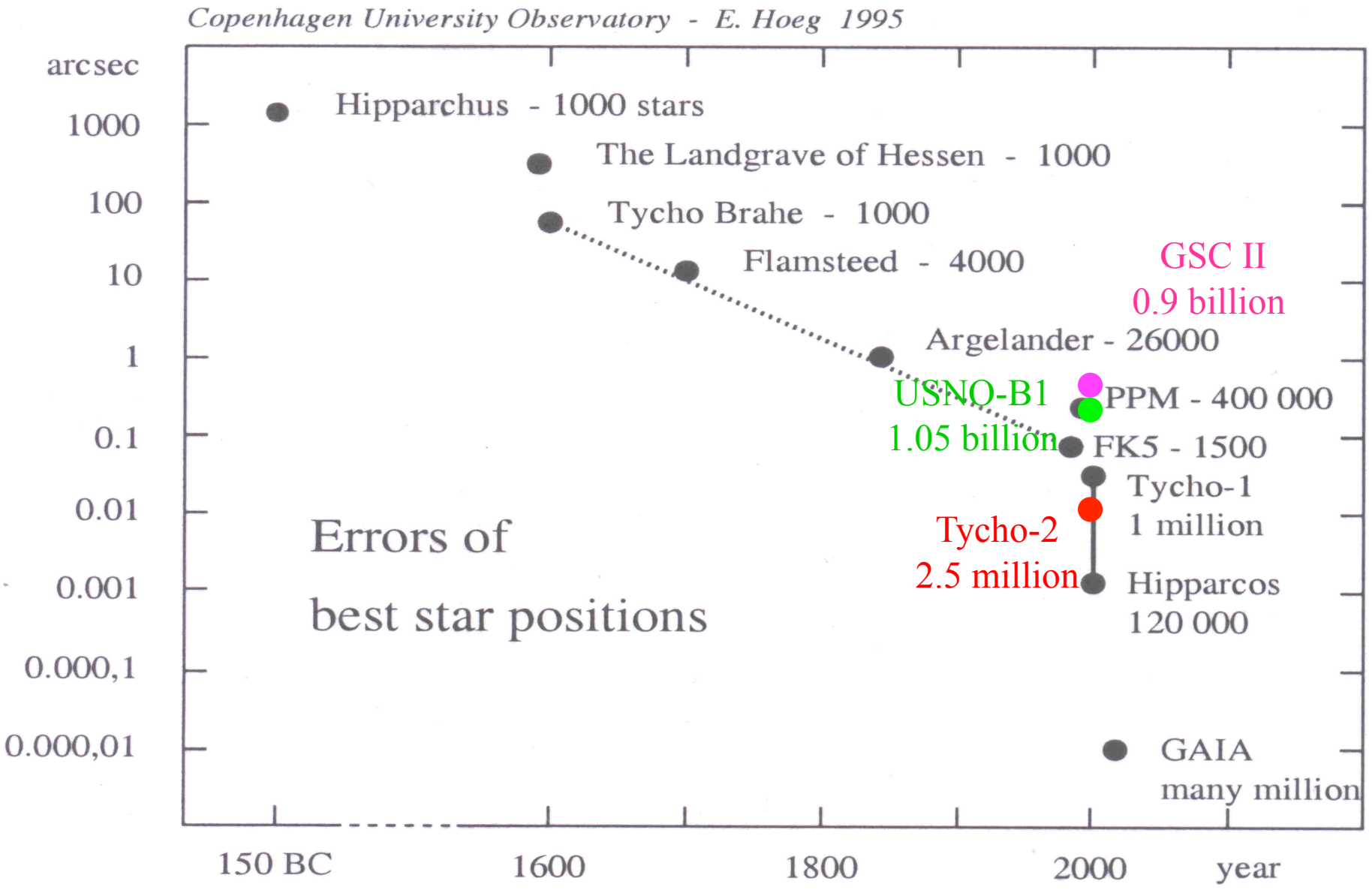
Hello!

Astronomy With Virtual Observatories

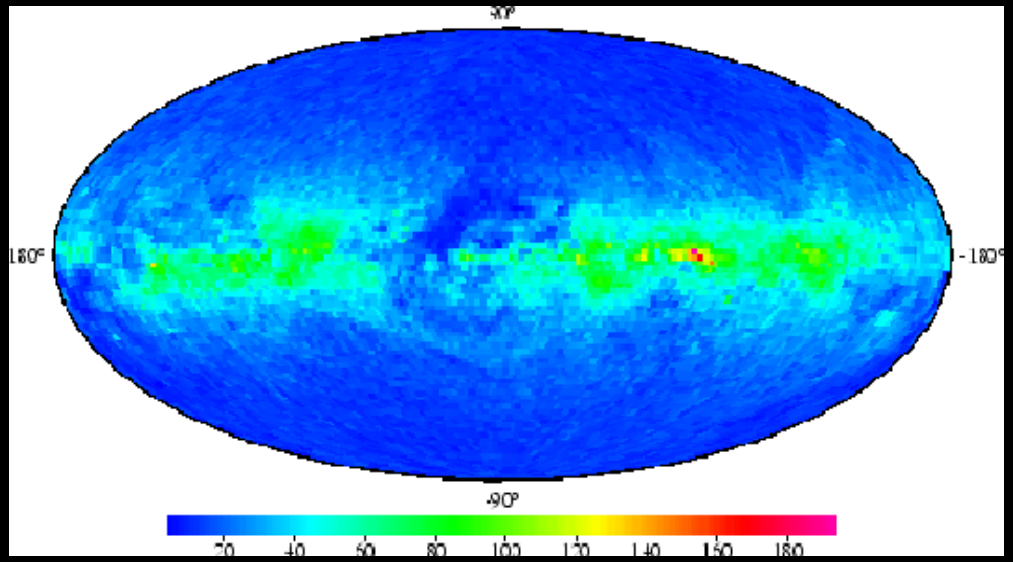
Ajit Kembhavi

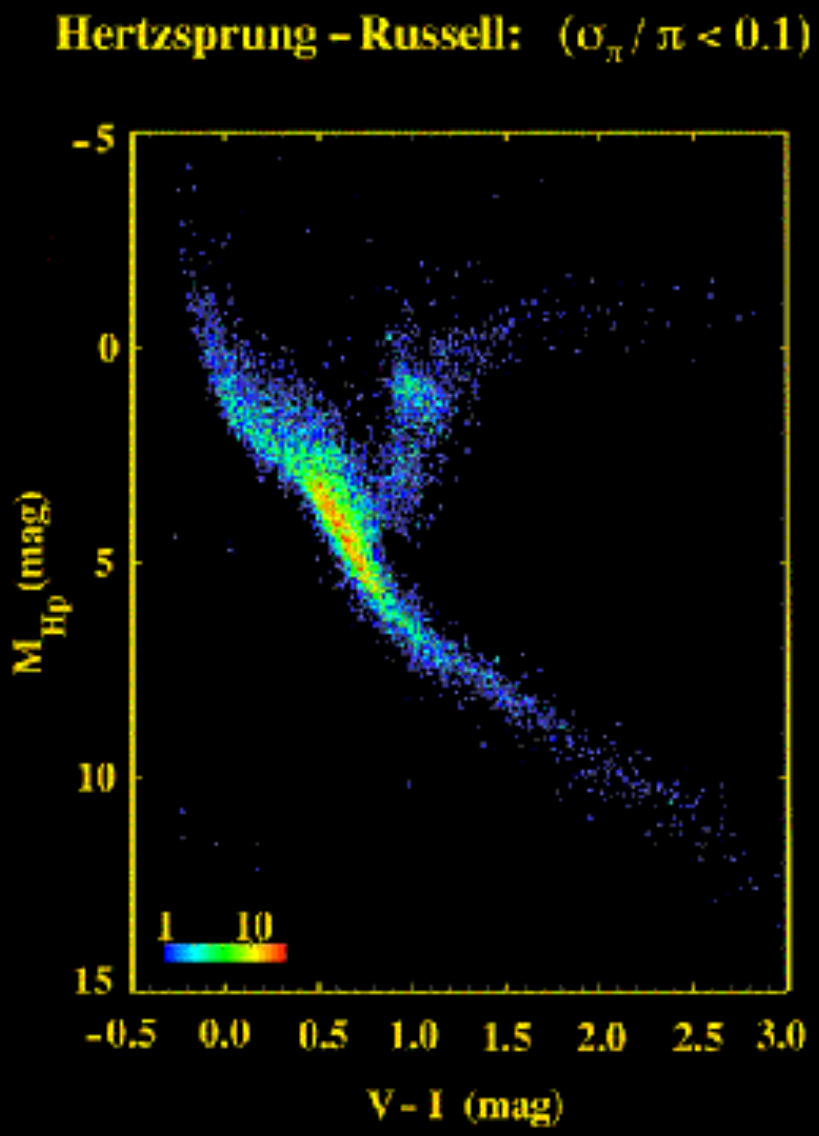
IUCAA, Pune



[1] E. Høg et al. 1995

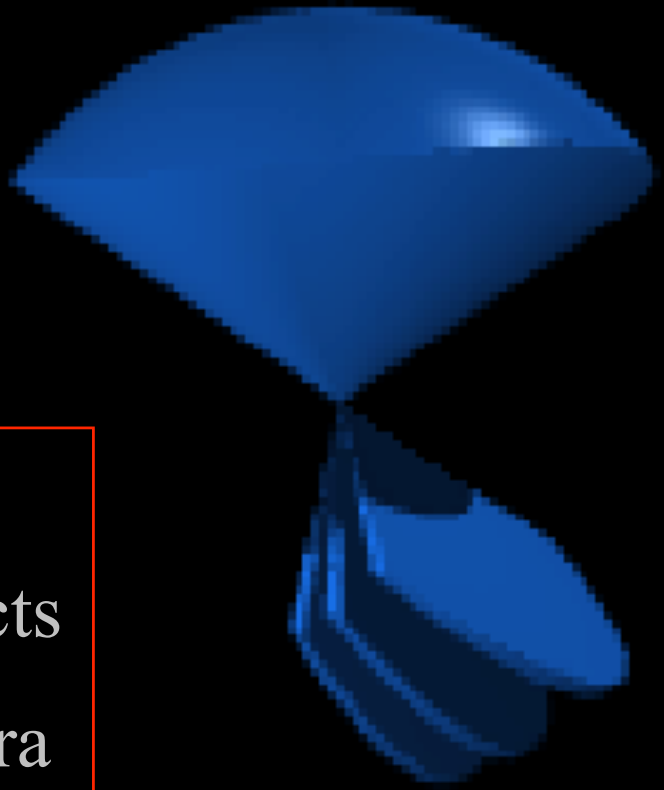
Stars in the Milky Way





Data Collections

Sloan Digital Sky Survey



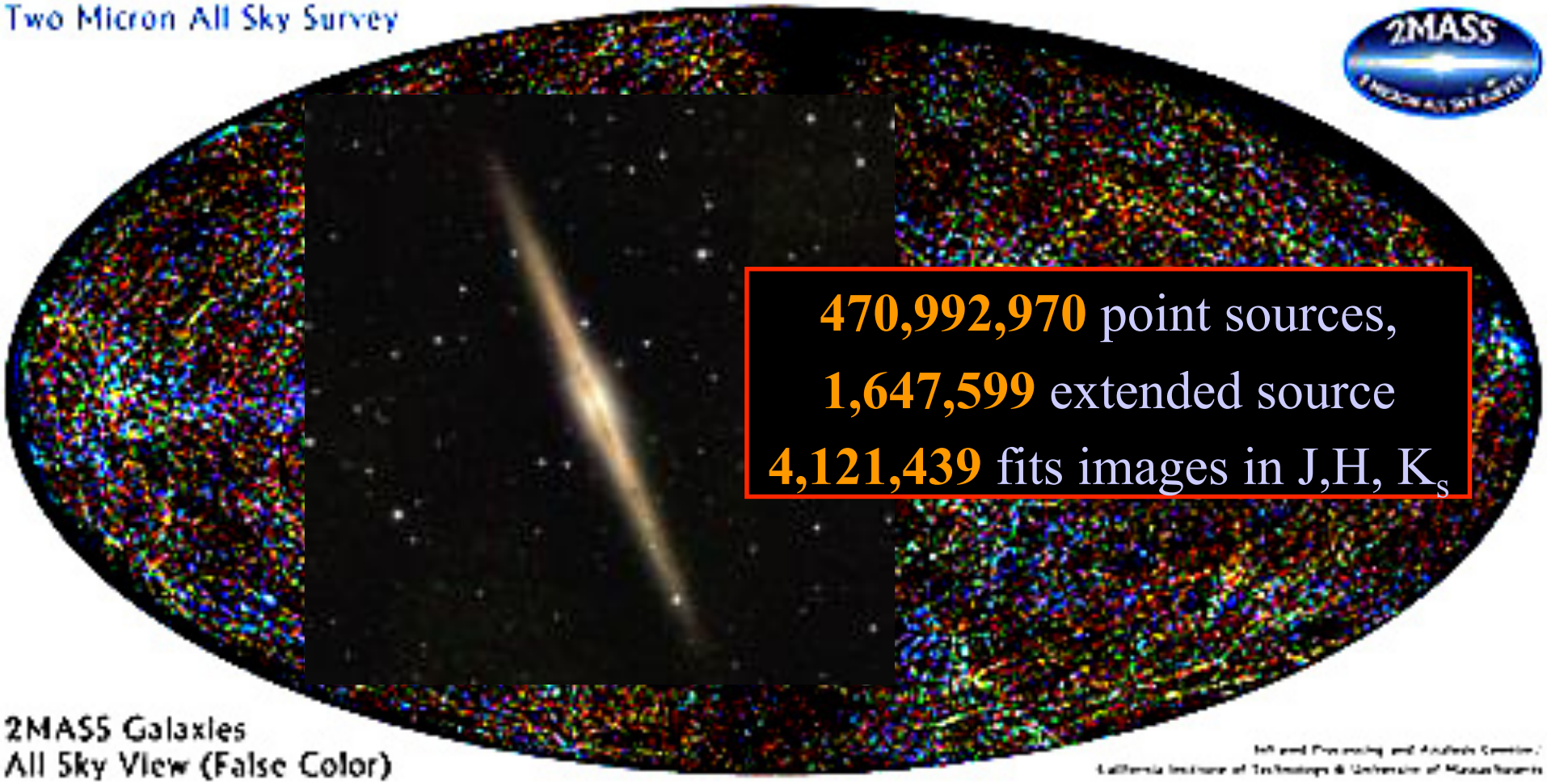
8000 deg^2

287 million objects

1.3 million spectra

10 TB imaging data

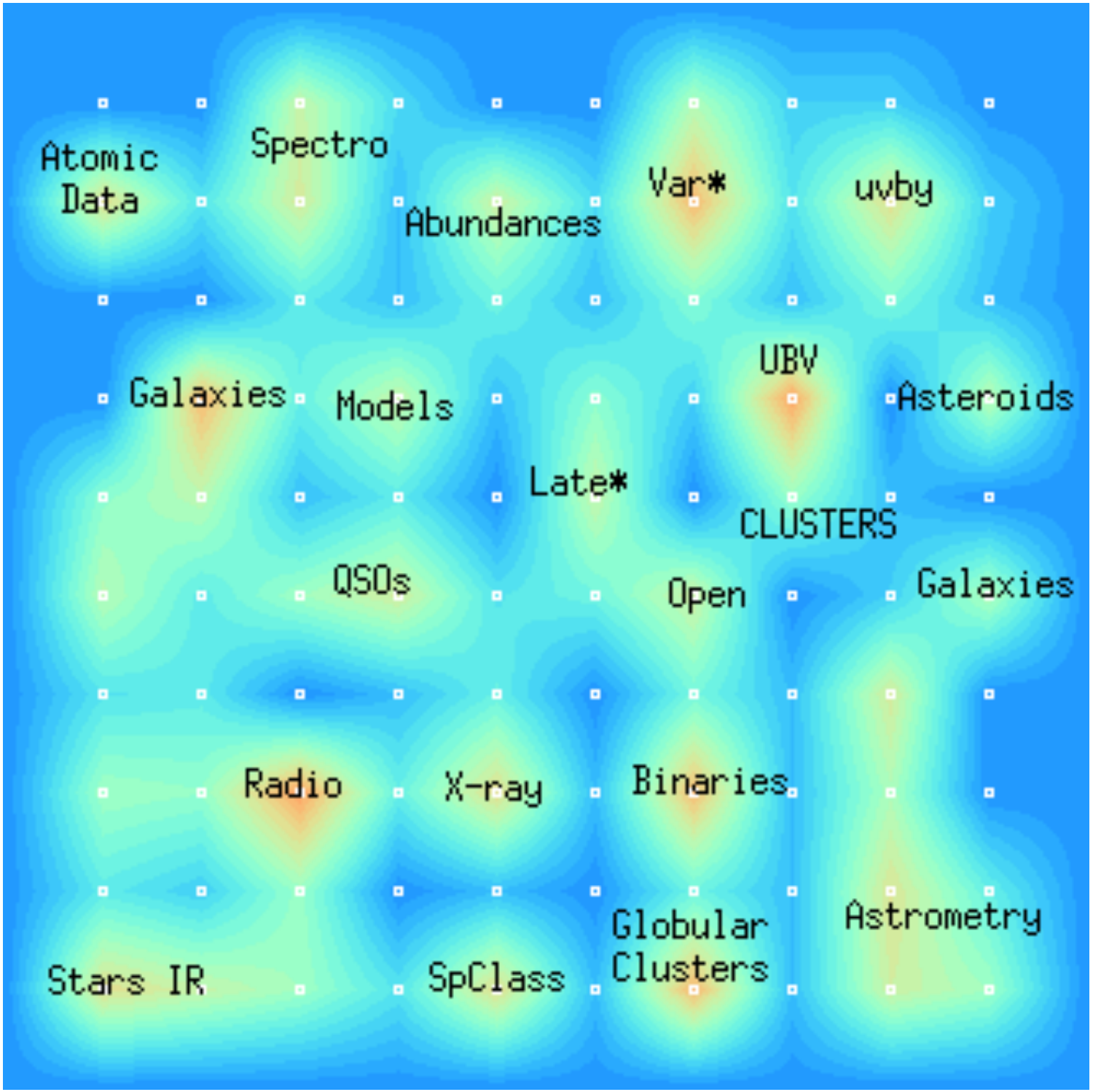
2 TB catalogue data



- Two 1.3m telescopes, Mt. Hopkins, CTIO
- 256x256 near-infrared arrays, 2x2 arcsec pixels, J, H, K bands, 7.8s integration time

9299

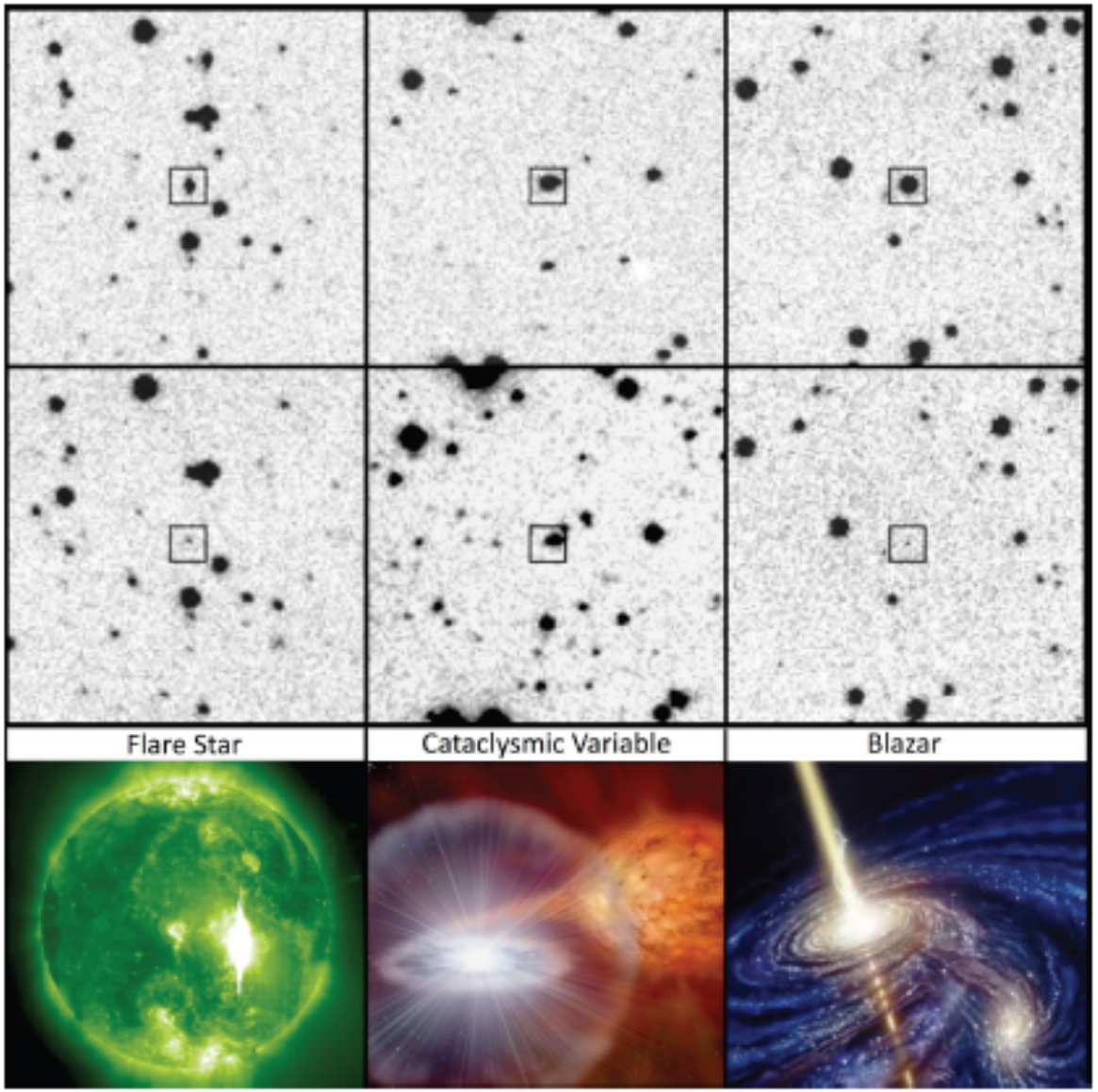
catalogues



Examples of CRTS Transients

They all *look* the same, but are physically very different types of phenomena

How do you decide and which ones do you follow?



Djorgovski

[2] Djorgovski et al. 2011

The Wave of the Future

- Now: data streams of ~ **0.1 TB** / **night,** ~ **10 - 10^2 transients** / **night** (CRTS, PTF, various SN surveys, asteroid surveys, etc.)
- Forthcoming on a time scale ~ 1 **-** 5 years: ~ **1 TB** / **night,** ~**10^4 transients** / **night** (PanSTARRS, Skymapper, VISTA, VST…)
- Forthcoming in ~ 8 **-** 10 years: LSST, ~ **20 TB** / **night,** ~ **10^5 - 10^6 transients** / **night**

A major, qualitative change!

- Observational follow-up needs:
  - Rapid photometric/positional monitoring
  - Rapid spectroscopy
  - Information/computation infrastructure

Transient classification technologies are essential

Djorgovski

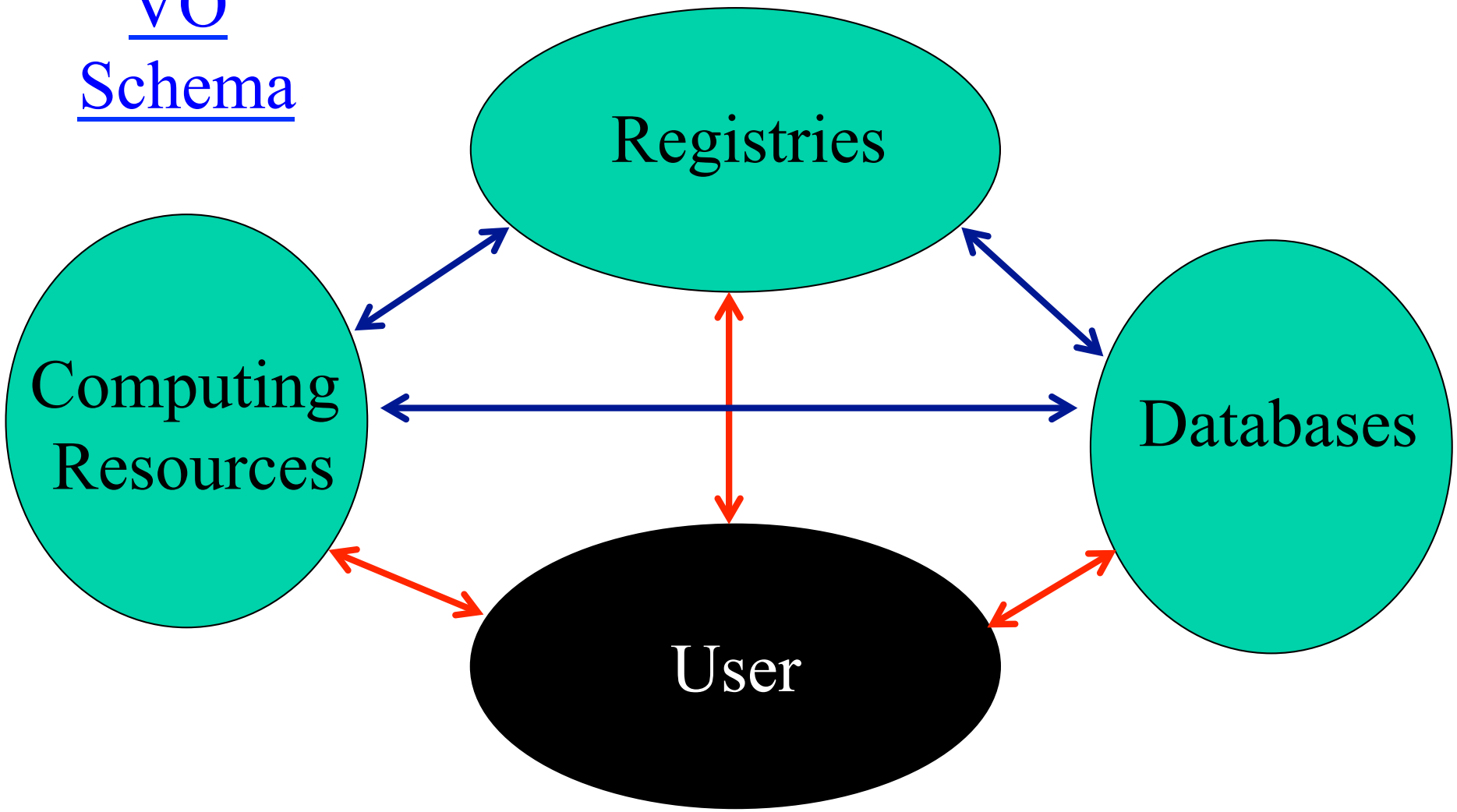
Virtual Observatories

Virtual Observatories

- Develop interoperability concepts to make different databases seamless.
- Manage vast data resources and provide these on-line to astronomers and other users.
- Provide computing power and tools for data analysis, visualization and mining.

New Science Initiatives

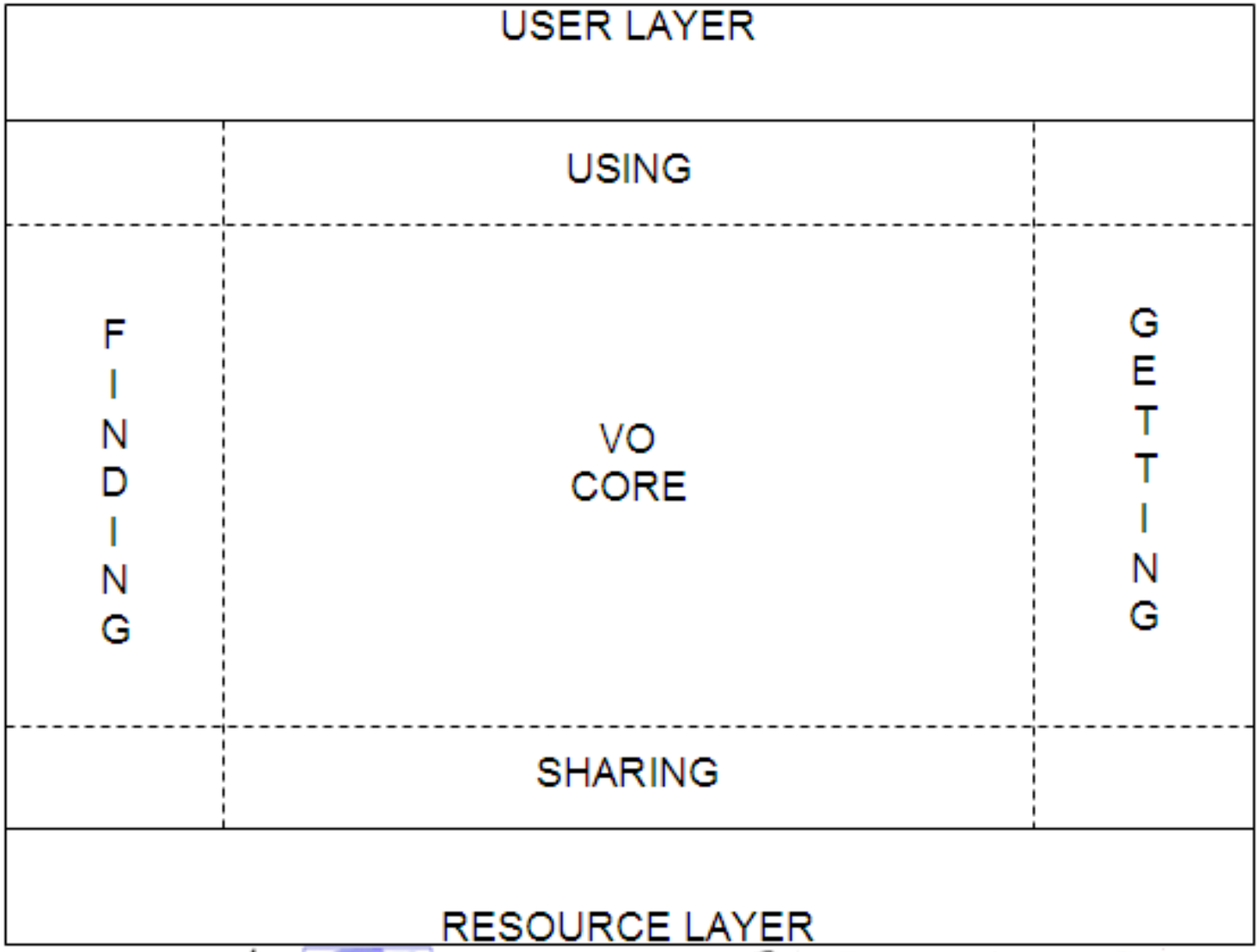
Empower astronomers, regardless of their location and circumstances, to use the vast, new pools of data for producing new science.



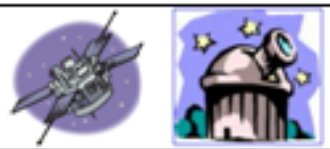
Data Models, UCDs, Data Formats, Query Language

[3] Arviset et al. 2010

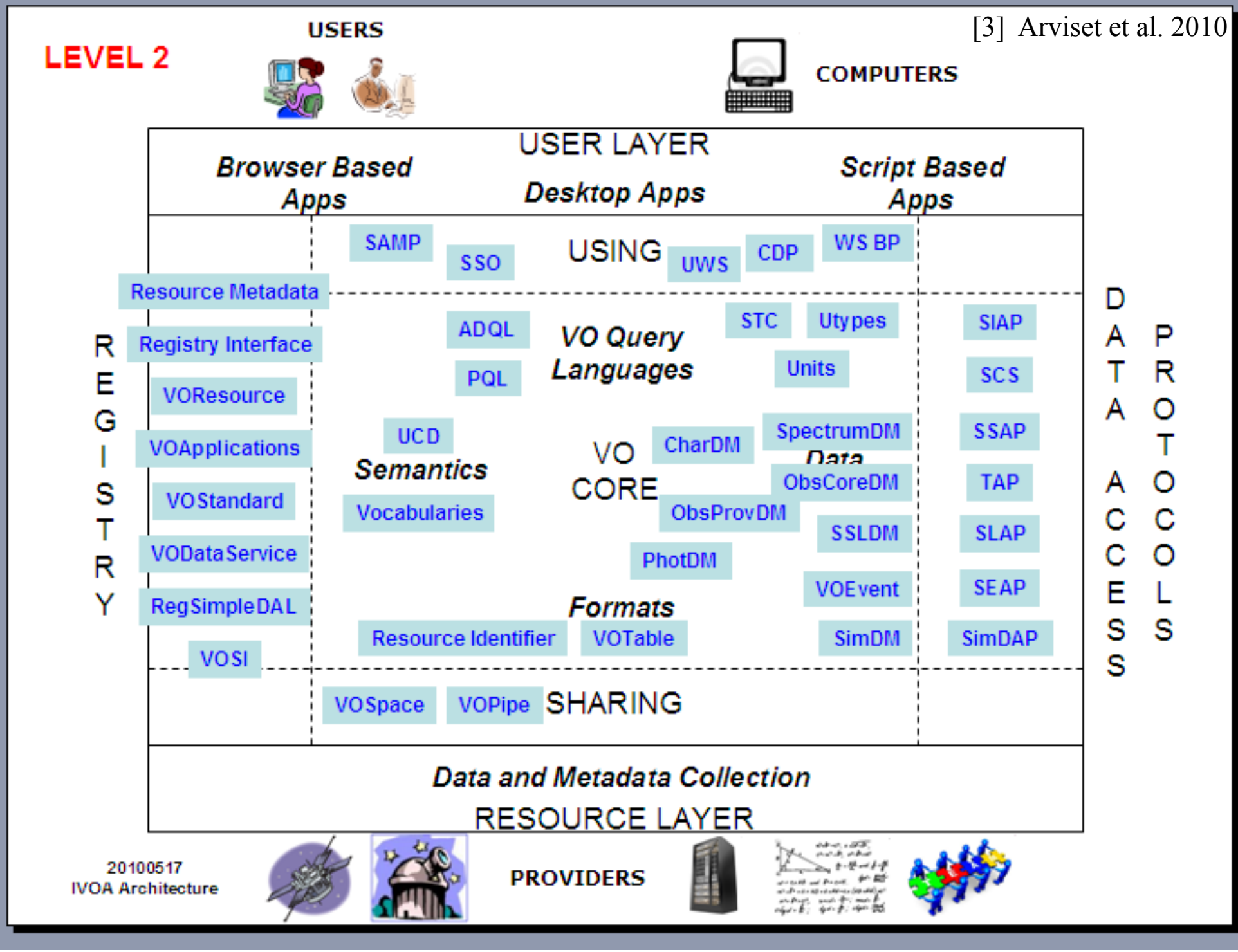
LEVEL 0

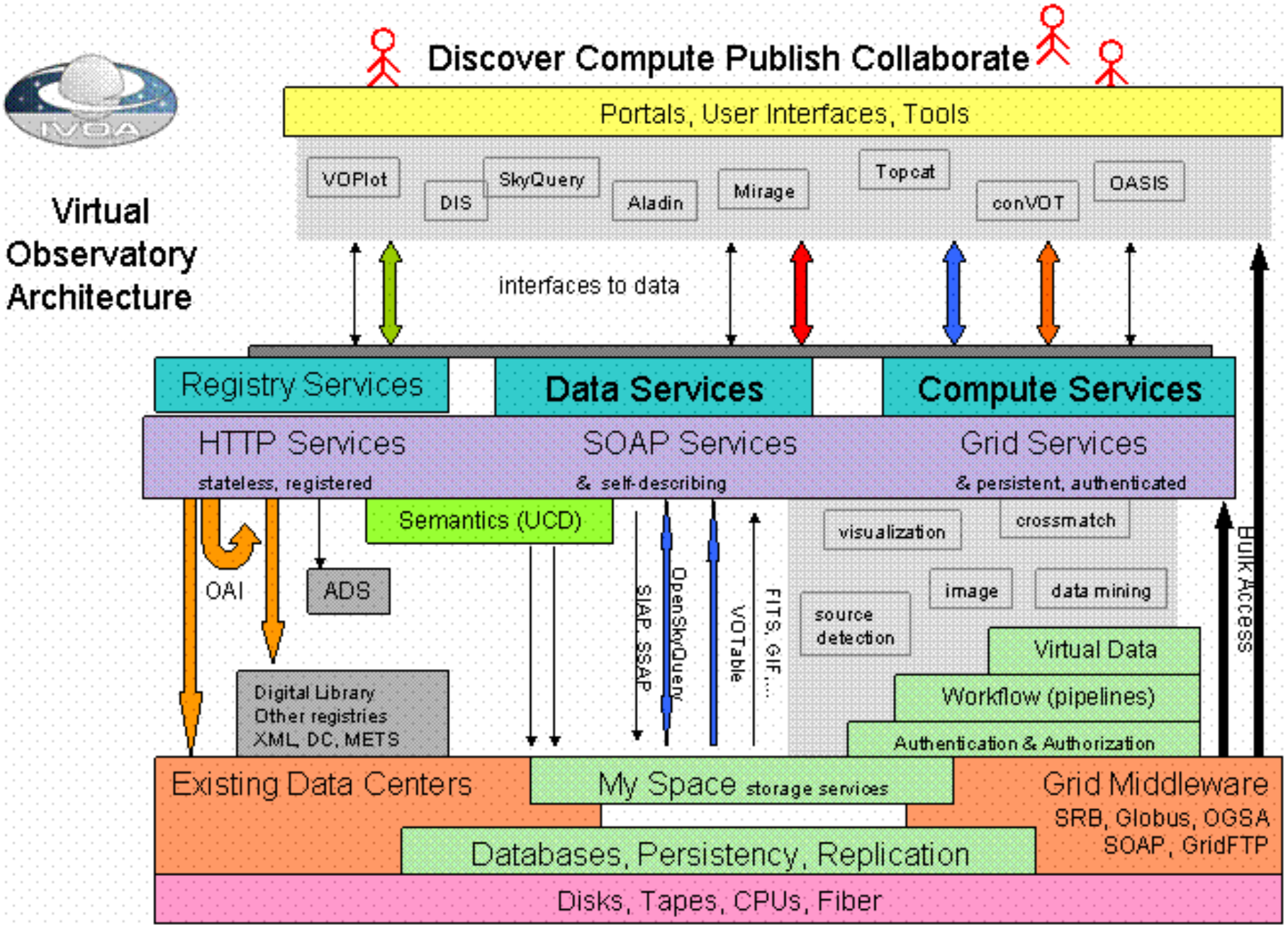


20100517
IVOA Architecture



[3] Arviset et al. 2010





IVOA (http://www.ivoa.net/Documents/Notes/IVOArch/IVOArch-20040615.html)

VO tools offer a variety of functionalities:

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

Evanthia Hatziminaoglou

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*			

[4] Science with the Virtual Observatory (Evanthia Hatziminaoglou)

VO Tools:
Image Cutout System
VOPlot, VOStat

Application

Sky Map | Job Output

0 RUNNING, 1 COMPLETE

51 (or) 1h12m44s,10d23m43s (or)

Go

s and mosaic Clear Markers

nark the center of cutout rectangle and
e size below

ctangle by clicking at two points

e Corners

39013 DEC: 47.11593
56454 DEC: 47.25966

ed inputs

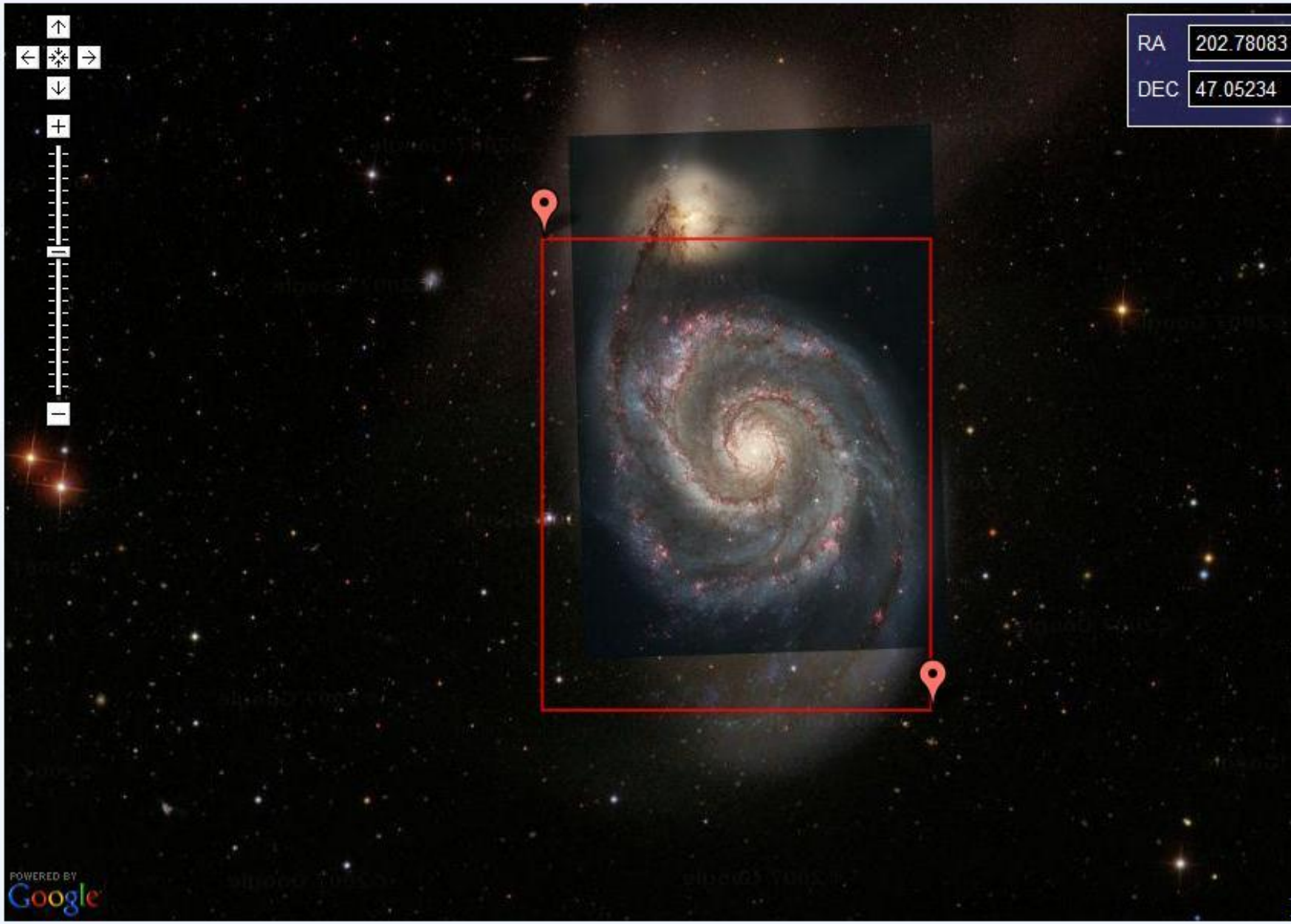
c/pixel) 0.39612

es:

- SDSS Ultraviolet(u)
- SDSS Green(g)
- SDSS Red(r)
- SDSS Near Infrared(i)
- SDSS Infrared(z)

infra_m51

Link to this page



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JobId#127 - Tasks information

Note: *To download the output fits file or image ,right click on the output link and click save as option*

Task	State	Input	Output
Set#0			
CUTOUT	COMPLETED	OBJECT NAME M51 RA 202.48220 degree DEC 47.23150 degree WIDTH_RA 0.2 degree WIDTH_DEC 0.2 degree SCALE 0.39612 arc-sec/pixel	**SDSS_R** Cutout png images 1 2 3 4 5 6 Cutout Fits Files 1 2 3 4 5 6 Load All Images
MOSAIC	COMPLETED		**SDSS_R** Swarp output fits png log Sextractor output fits png catalog Output Zip

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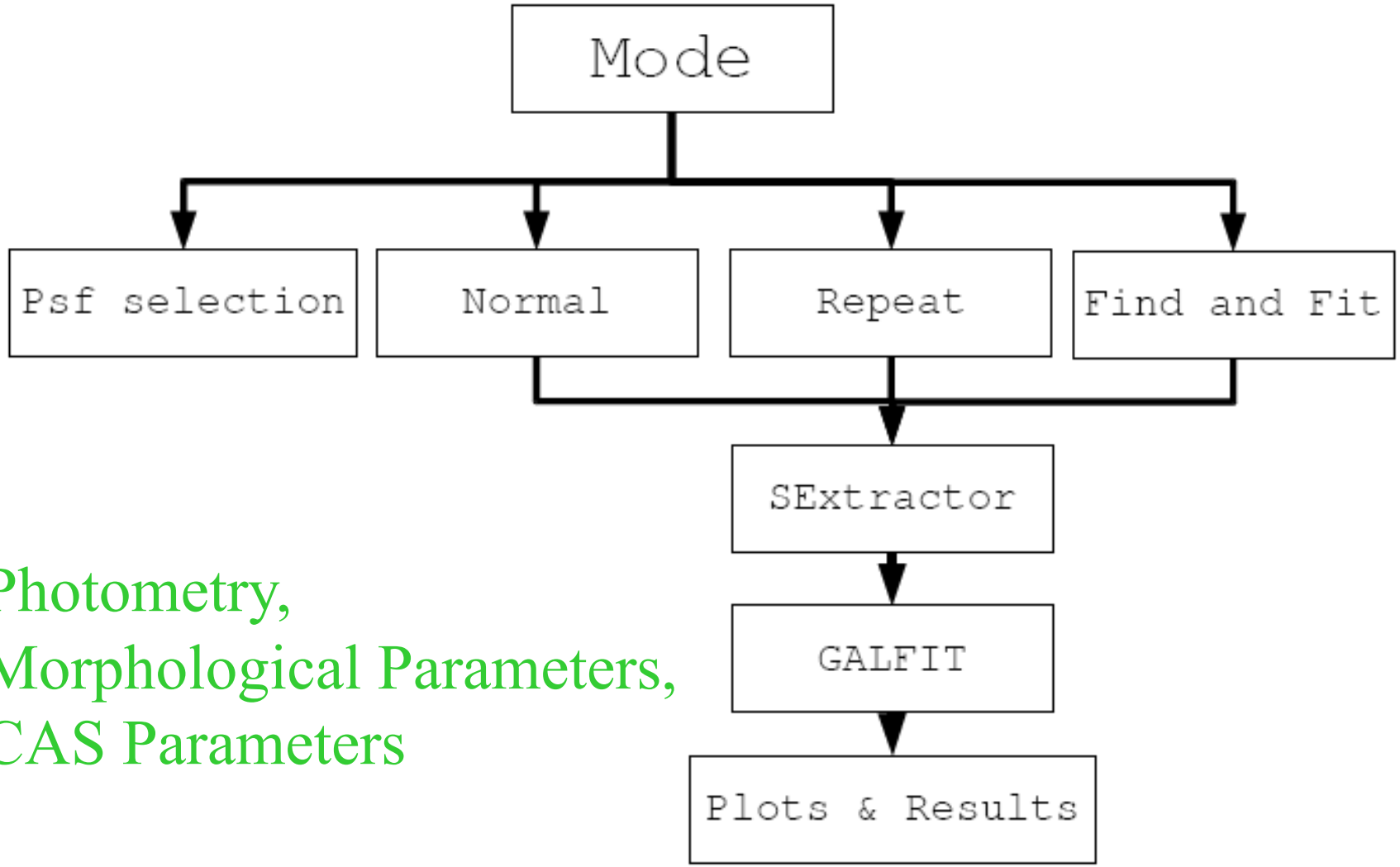
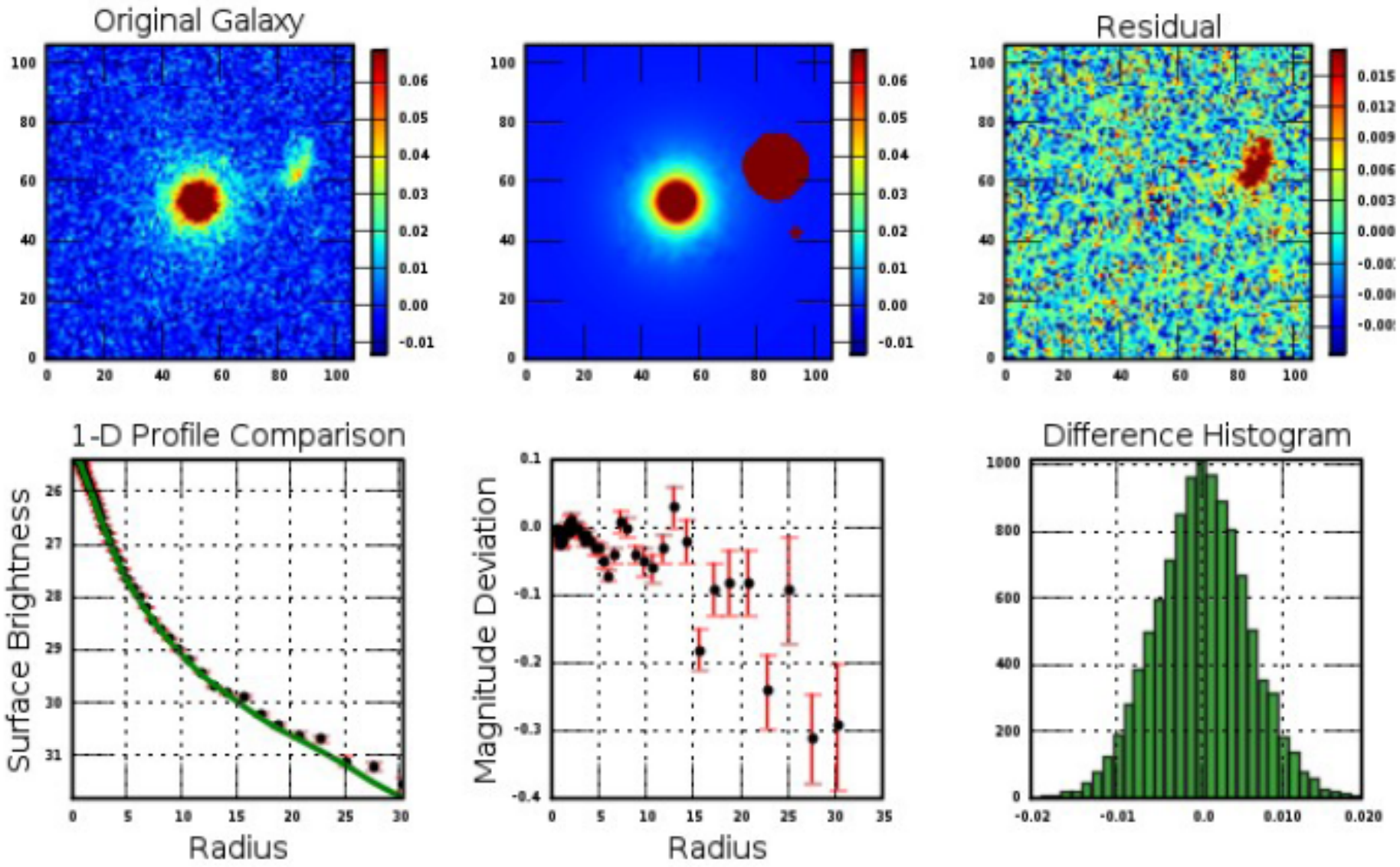
s: voindia@vo.iucaa.ernet.in

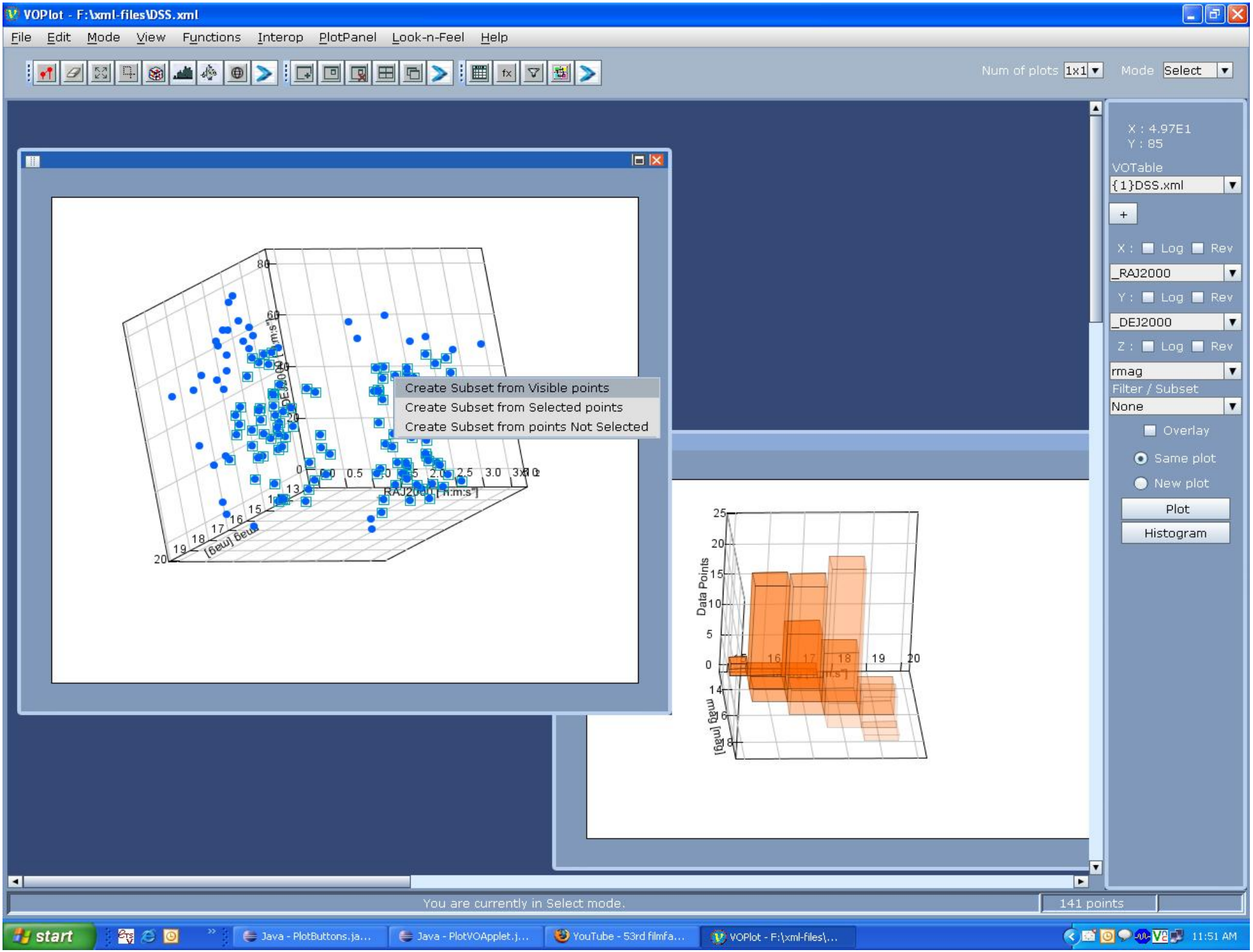
PyMorph Pipeline

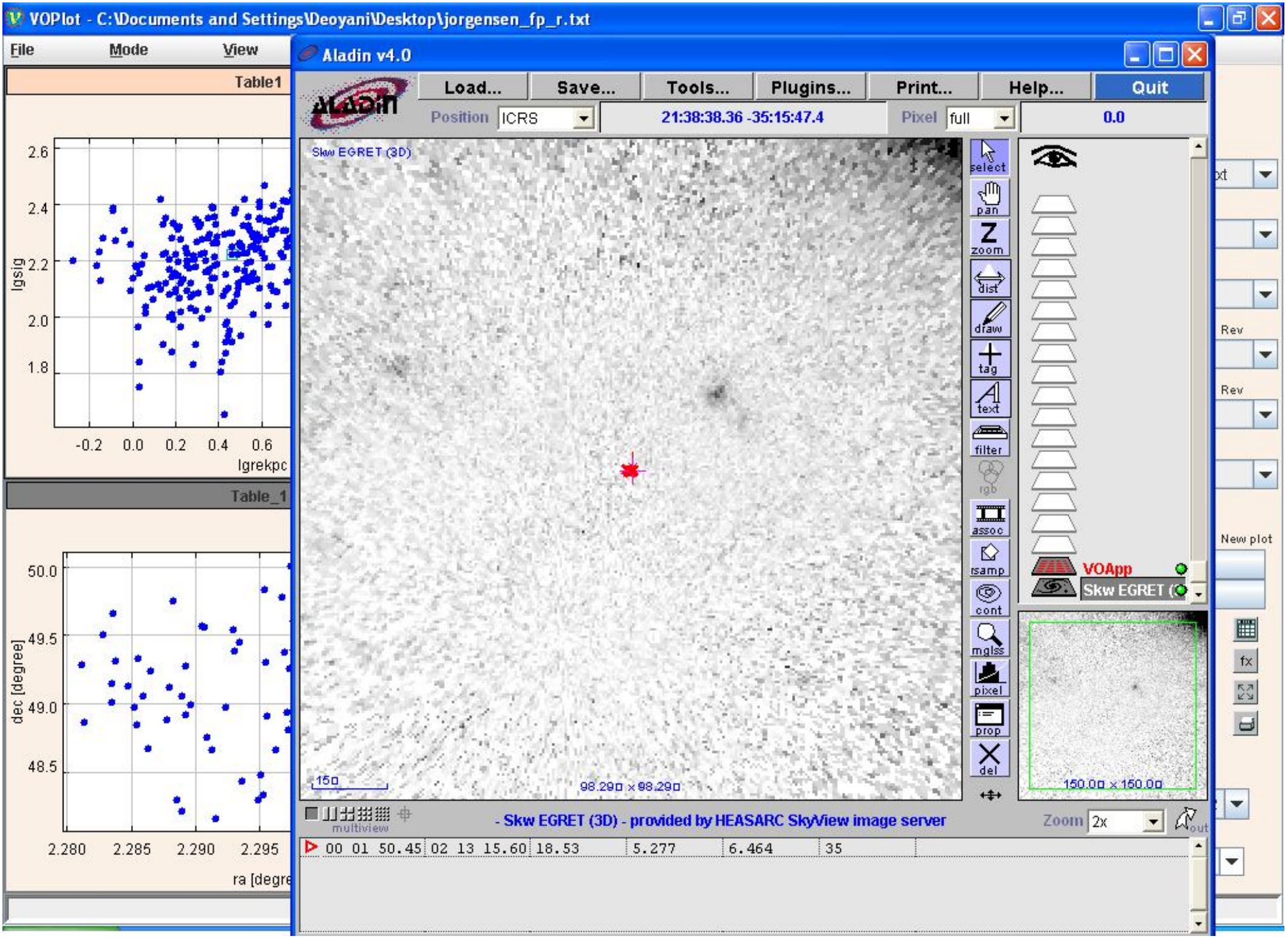


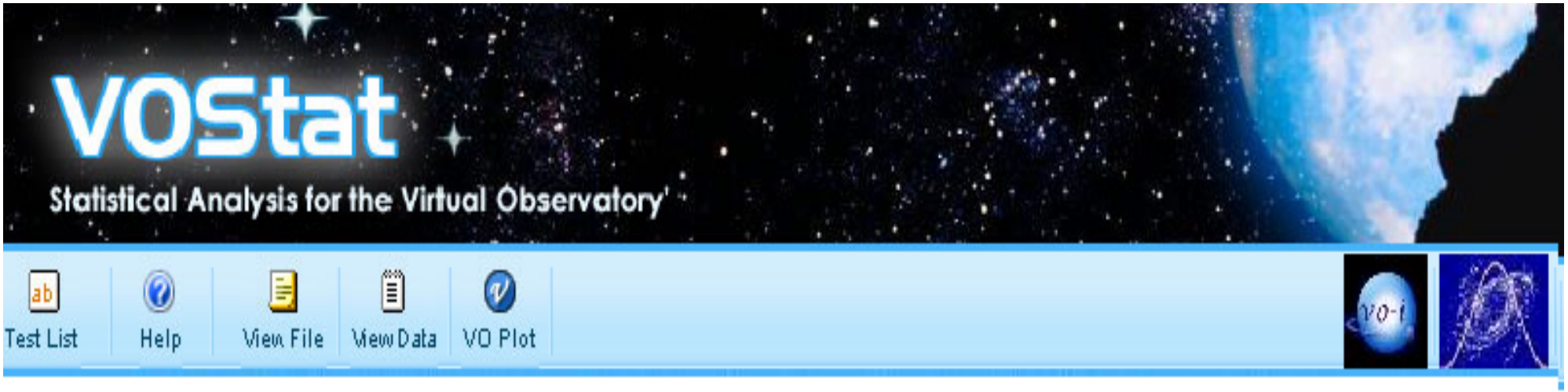
Photometry,
Morphological Parameters,
CAS Parameters



VOI PyMorph Service URL http://vo.iucaa.ernet.in/~voi/VOIPymorphService.html


VOPlot - F:\xml-files\DSS.xml
File Edit Mode View Functions Interop PlotPanel Look-n-Feel Help
Num of plots 1x1
Mode Select
X : 4.97E1
Y : 85
VOTable
{1}DSS.xml
+
X : Log Rev
_RAJ2000
Y : Log Rev
_DEJ2000
Z : Log Rev
rmag
Filter / Subset
None
Overlay
Same plot
New plot
Plot
Histogram
Create Subset from Visible points
Create Subset from Selected points
Create Subset from points Not Selected
RAJ2000 [h:m:s]
DEJ2000 [d:m:s]
[mag] rmag
Data Points
You are currently in Select mode.
141 points
start
Java - PlotButtons.ja...
Java - PlotVOApplet.j...
YouTube - 53rd filmfa...
VOPlot - F:\xml-files\...
11:51 AM


VOPlot - C:\Documents and Settings\Deoyani\Desktop\jorgensen_fp_r.txt
File
Mode
View
Table1
lgsig
lgrekpc
Table_1
dec [degree]
ra [degre
Aladin v4.0
Load...
Save...
Tools...
Plugins...
Print...
Help...
Quit
Position
ICRS
21:38:38.36 -35:15:47.4
Pixel
full
0.0
Skw EGRET (3D)
select
pan
zoom
dist
draw
tag
text
filter
rgb
assoc
rsamp
cont
mglss
pixel
prop
del
VOApp
Skw EGRET (
150
98.29□ x 98.29□
150.0□ x 150.0□
multiview
- Skw EGRET (3D) - provided by HEASARC SkyView image server
Zoom
2x
out
00 01 50.45
02 13 15.60
18.53
5.277
6.464
35
Rev
Rev
New plot
fx



UPLOAD FILE/URL

File Type: ASCII VOTABLE

Type in a URL:

http://vo.iucaa.ernet.in/Sample_files/HDF_G

OR Choose a file:

C:\Documents and Settir Browse...

Load Table or File

Input file: Burbidge.xml

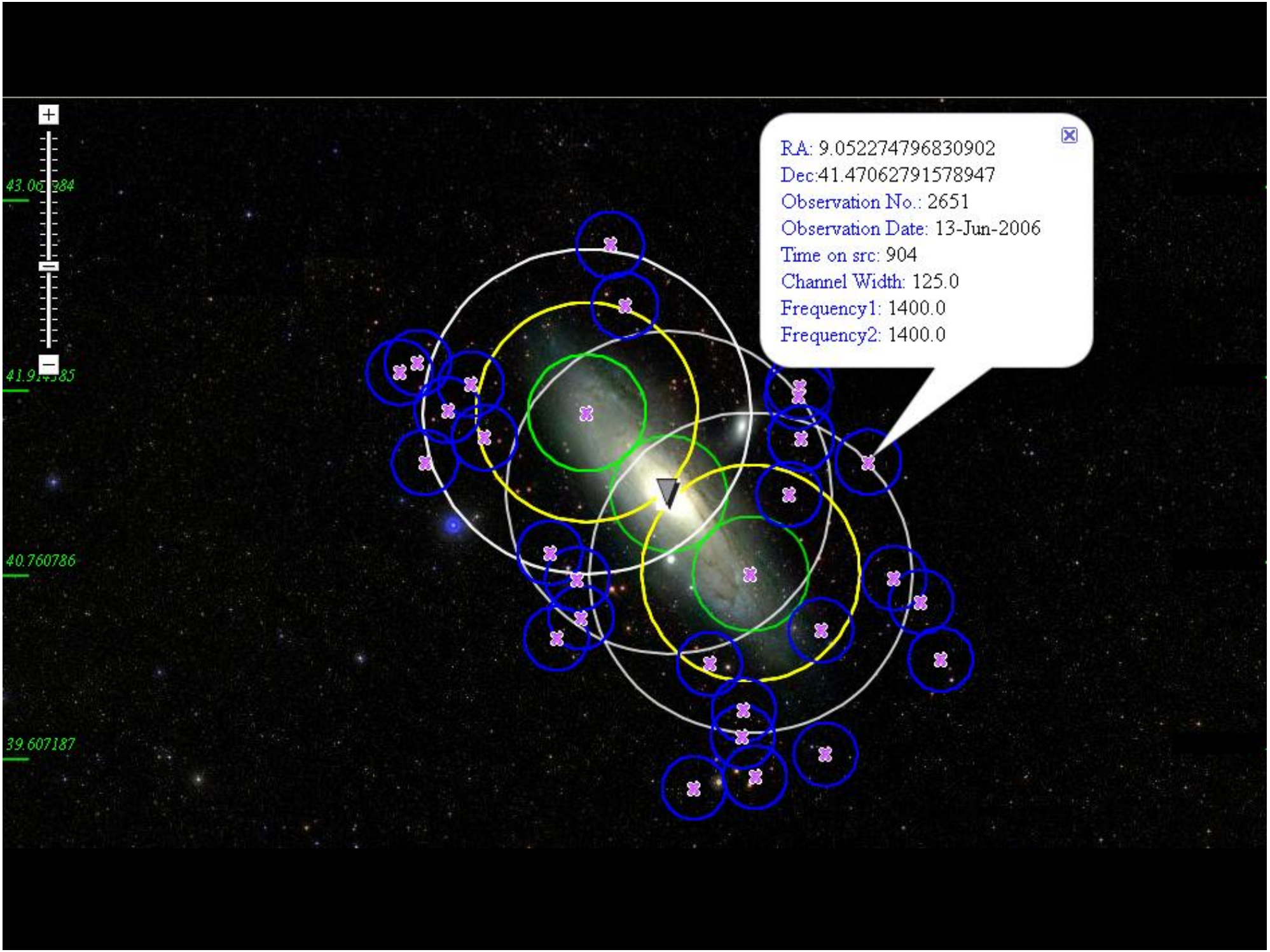
SELECT CATEGORY

Descriptive	Tests	Exploratory Tools
	ate ation	Curve Fitting
	metric ds	Two and k-sample Tests
	sion	

Descriptive Statistics

- Mean Standard Deviation .....
- BoxPlot
- Histogram
- Weighted Mean
- Correlation Matrix

Ok Cancel


RA: 9.052274796830902
Dec:41.47062791578947
Observation No.: 2651
Observation Date: 13-Jun-2006
Time on src: 904
Channel Width: 125.0
Frequency1: 1400.0
Frequency2: 1400.0
40.760786
39.607187

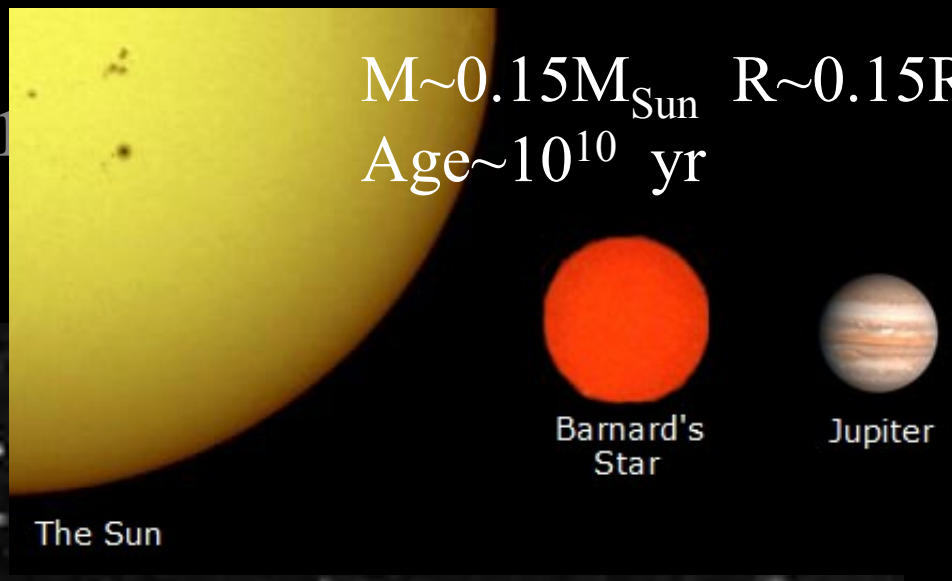
Simple Astronomical Applications

Proper Motion of Barnard's Star

Ba

$M \sim 0.15 M_{Sun}$ $R \sim 0.15 R_{Sun}$

Age~10^{10} yr

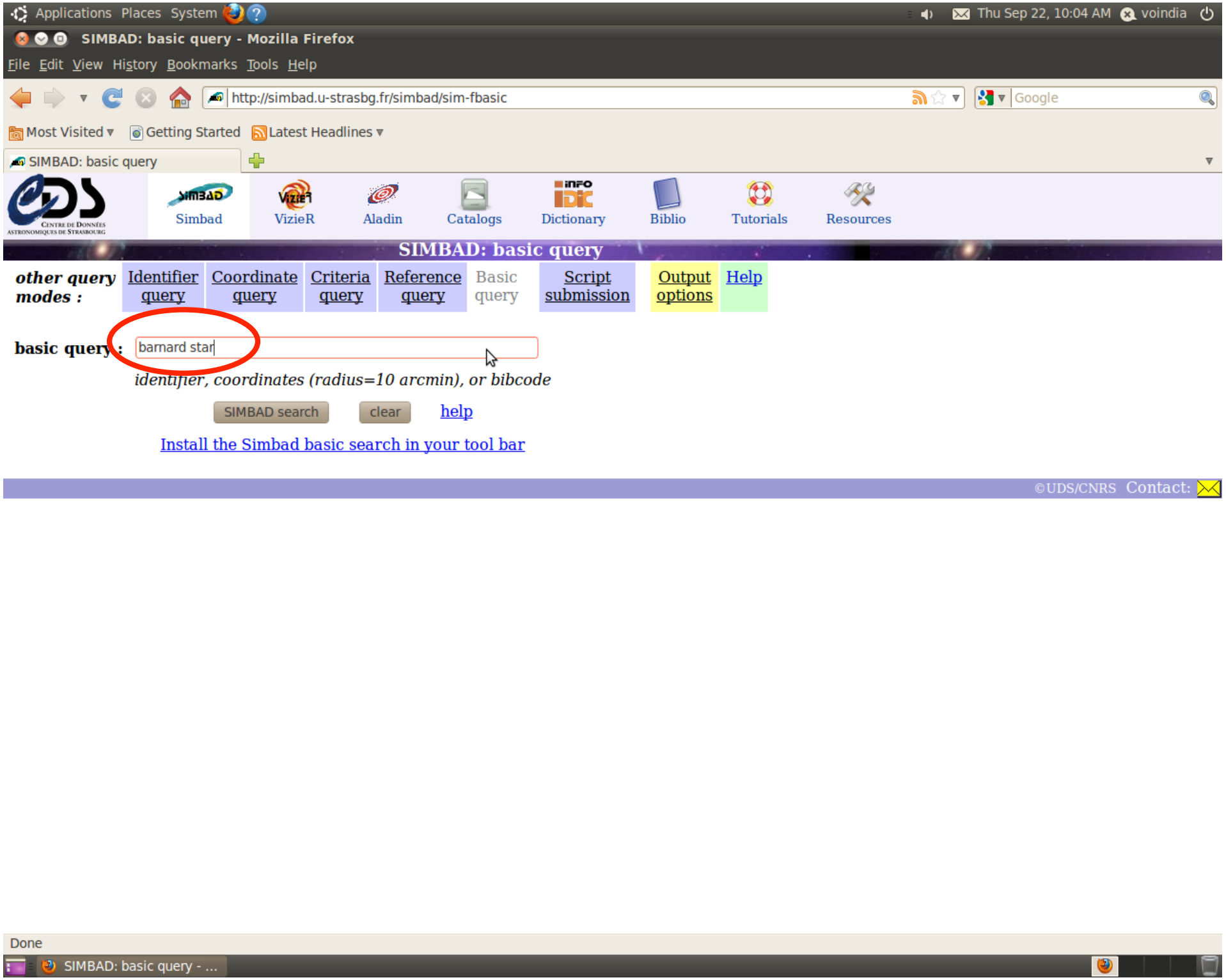


Very low mass red dwarf star.
High proper motion 10.3”/yr.
Suspected to have a planetary companion by Van de Kamp.

Constellation Ophiuchus,
V=9.54, distance 6 ly

[5] Andromeda Child

http://www.andromedachild.com/2011/06/lost-world-of-barnards-star.html

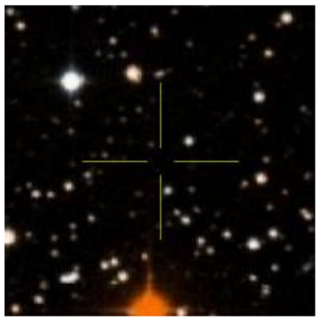

Applications Places System
Thu Sep 22, 10:04 AM voindia
SIMBAD: basic query - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://simbad.u-strasbg.fr/simbad/sim-fbasic
Google
Most Visited
Getting Started
Latest Headlines
SIMBAD: basic query
Simbad
VizieR
Aladin
Catalogs
Dictionary
Biblio
Tutorials
Resources
SIMBAD: basic query
other query modes :
Identifier query
Coordinate query
Criteria query
Reference query
Basic query
Script submission
Output options
Help
basic query :
barnard star
identifier, coordinates (radius=10 arcmin), or bibcode
SIMBAD search
clear
help
Install the Simbad basic search in your tool bar
©UDS/CNRS Contact:
Done
SIMBAD: basic query - ...

Applications Places System Thu Sep 22, 10:04 AM voindia
SIMBAD basic query result - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://simbad.u-strasbg.fr/simbad/sim-basic?Ident=barnard+star&submit=SIMBAD+search
Google
Most Visited Getting Started Latest Headlines
SIMBAD basic query result

Basic data :

V* V2500 Oph -- Variable of BY Dra type

query around with radius 2 arcmin



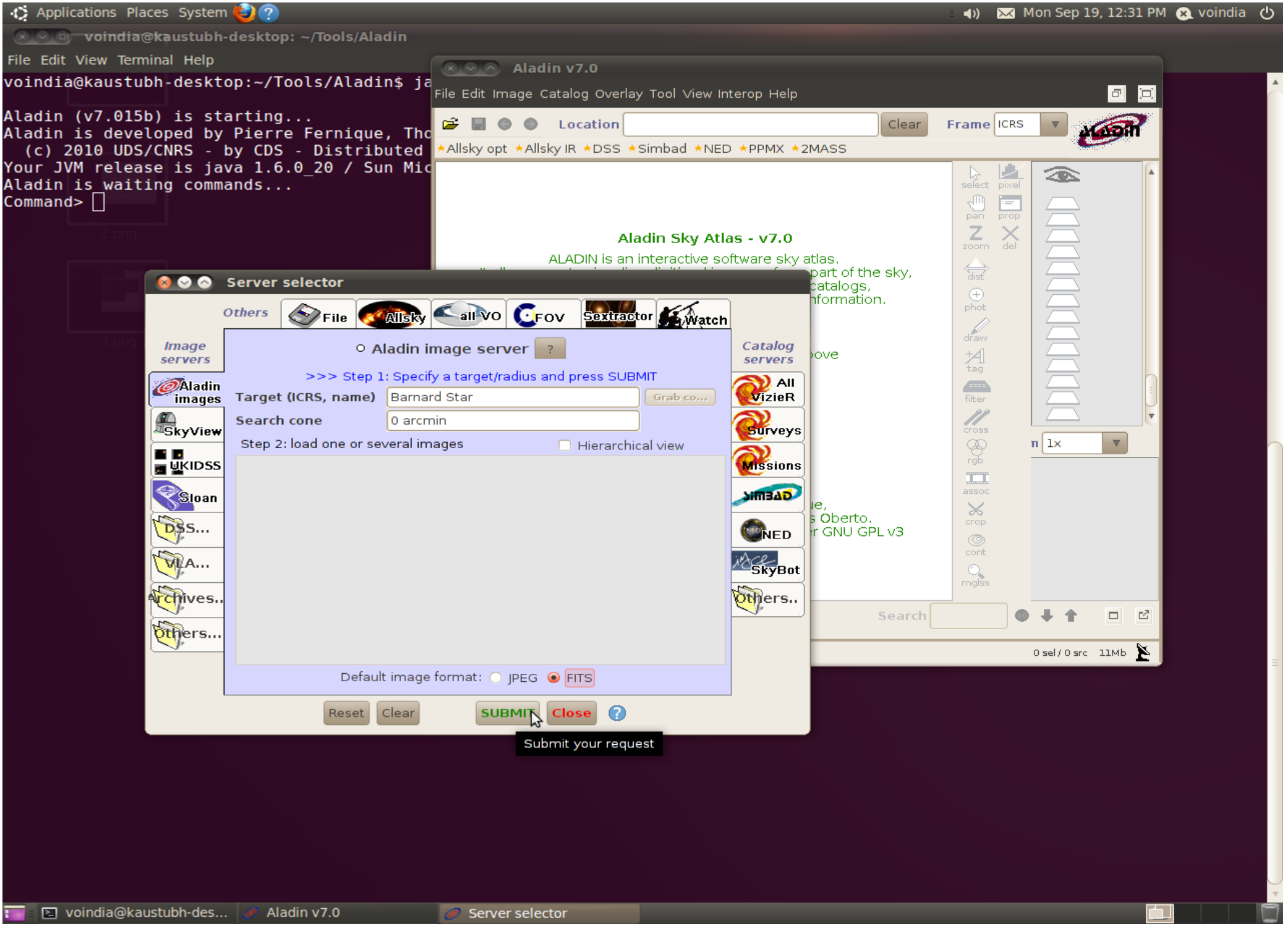
Other object types:	EB* () , BY* () , * (AC2000,ASCC,BD,CSI,GAT,GCRV,GJ,GSC,HIC,HIP,JP11,MCC,8pc,PLX,TYC,UBV,UCAC2,USNO,VVO,Zkh,[RHG95]) , PM* (Ci,G,LFT,LHS,LSPM,LTT,NLTT) , V* (V*,CSV,NSV) , IR (IRAS,2MASS) , X (1E) , ** (CCDM)
ICRS coord. (ep=J2000) :	17 57 48.49803 +04 41 36.2072 (Optical) [15.10 10.72 0] A 2007A&A...474..653V
FK5 coord. (ep=J2000 eq=2000) :	17 57 48.498 +04 41 36.21 (Optical) [15.10 10.72 89] A 2007A&A...474..653V
FK4 coord. (ep=B1950 eq=1950) :	17 55 22.70 +04 33 14.6 (Optical) [87.32 61.94 0] A 2007A&A...474..653V
Gal coord. (ep=J2000) :	031.0087 +14.0627 (Optical) [15.10 10.72 0] A 2007A&A...474..653V
Proper motions *mas/yr* [error ellipse]:	-798.58 10328.12 [1.72 1.22 0] A 2007A&A...474..653V
Radial velocity / Redshift / cz :	V(km/s) -106.8 [~] / z(~) -0.000356 [~] / cz -106.78 [~] (~) D 1979IAUS...30...57E
Parallaxes *mas*:	548.31 [1.51] A 2007A&A...474..653V
Spectral type:	M4.0V C 2009ApJ...704..975J
Fluxes (8) :	U 12.497 [~] C 2010MNRAS.403.1949K B 11.24 [~] C 2010MNRAS.403.1949K V 9.511 [~] C 2010MNRAS.403.1949K R 8.298 [~] C 2010MNRAS.403.1949K I 6.741 [~] C 2010MNRAS.403.1949K J 5.24 [~] C 2003yCat.2246....0C H 4.83 [~] C 2003yCat.2246....0C K 4.52 [~] C 2003yCat.2246....0C

essential notes: • not BD+04 3561

Identifiers (41) :

V* V2500 Oph	G 140-24	LTT 15309	UBV 15269
AC2000 146626	GJ 699	2MASS J17574849+0441405	UCAC2 33428712
ASCC 1153178	GSC 00425-00184	MCC 799	USNO-B1.0 0946-00315199
BD+04 3561a	GSC 00425-02502	NAME BARNARD'S STAR	USNO 347
CCDM J17578+0441A	HIC 87937	NAME BARNARD STAR	USNO 876
Ci 20 1069	HIP 87937	NLTT 45718	VVO 6
CSI+04-17554	IRAS 17553+0438	NSV 9910	Zkh 269
CSV 7737	JP11 18	8pc 549.01	[RHG95] 2849
1E 1755.3+0438	LFT 1385	PLX 4098.00	
GAT 12	LHS 57	PLX 4098	

Done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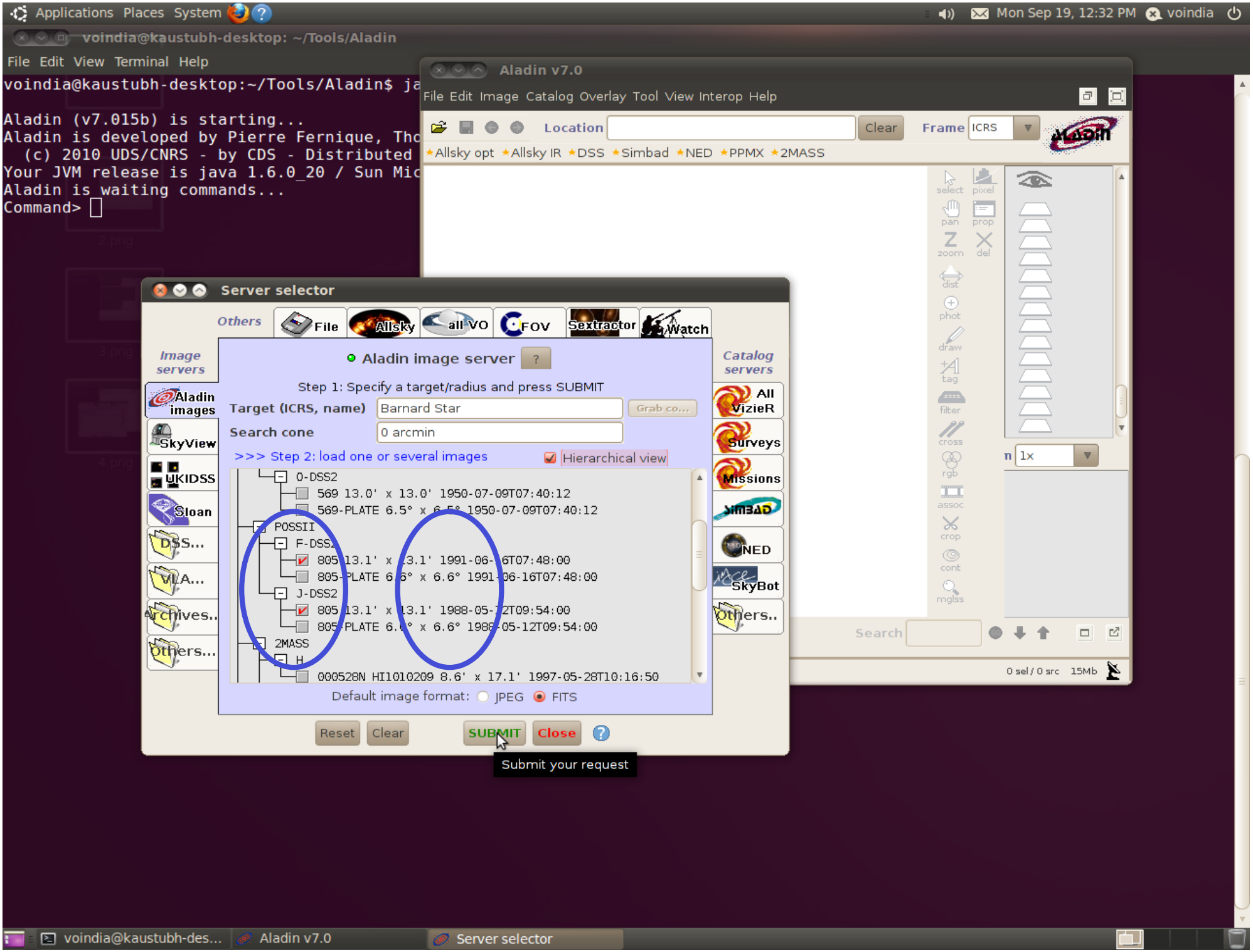
Mon Sep 19, 12:31 PM voindia
voindia@kaustubh-desktop: ~/Tools/Aladin
File Edit View Terminal Help
voindia@kaustubh-desktop:~/Tools/Aladin$ ja
Aladin (v7.015b) is starting...
Aladin is developed by Pierre Fernique, Tho
(c) 2010 UDS/CNRS - by CDS - Distributed
Your JVM release is java 1.6.0_20 / Sun Mic
Aladin is waiting commands...
Command>
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame
ICRS
Allsky opt
Allsky IR
DSS
Simbad
NED
PPMX
2MASS
Aladin Sky Atlas - v7.0
ALADIN is an interactive software sky atlas.
Server selector
Others
File
Allsky
all VO
FOV
Sextractor
Watch
Image servers
Aladin image server
Catalog servers
>>> Step 1: Specify a target/radius and press SUBMIT
Target (ICRS, name)
Barnard Star
Search cone
0 arcmin
Step 2: load one or several images
Hierarchical view
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives..
Others...
All VizieR
Surveys
Missions
SIMBAD
NED
SkyBot
Others..
Default image format:
JPEG
FITS
Reset
Clear
SUBMIT
Close
Submit your request
Search
0 sel / 0 src
11Mb
voindia@kaustubh-des...
Aladin v7.0
Server selector


Applications Places System
Mon Sep 19, 12:32 PM voindia
voindia@kaustubh-desktop: ~/Tools/Aladin
File Edit View Terminal Help
voindia@kaustubh-desktop:~/Tools/Aladin$ ja
Aladin (v7.015b) is starting...
Aladin is developed by Pierre Fernique, Tho
(c) 2010 UDS/CNRS - by CDS - Distributed
Your JVM release is java 1.6.0_20 / Sun Mic
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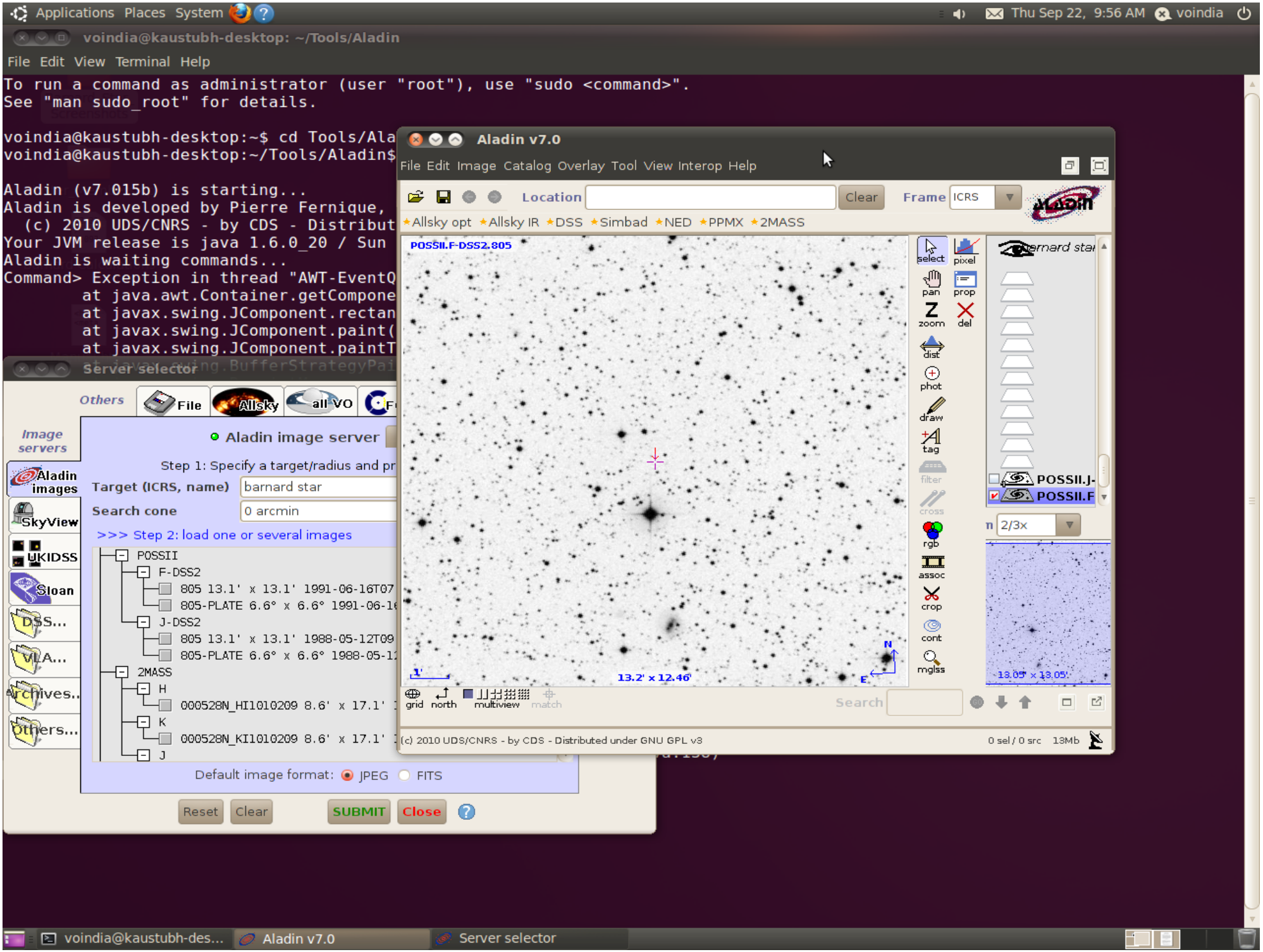
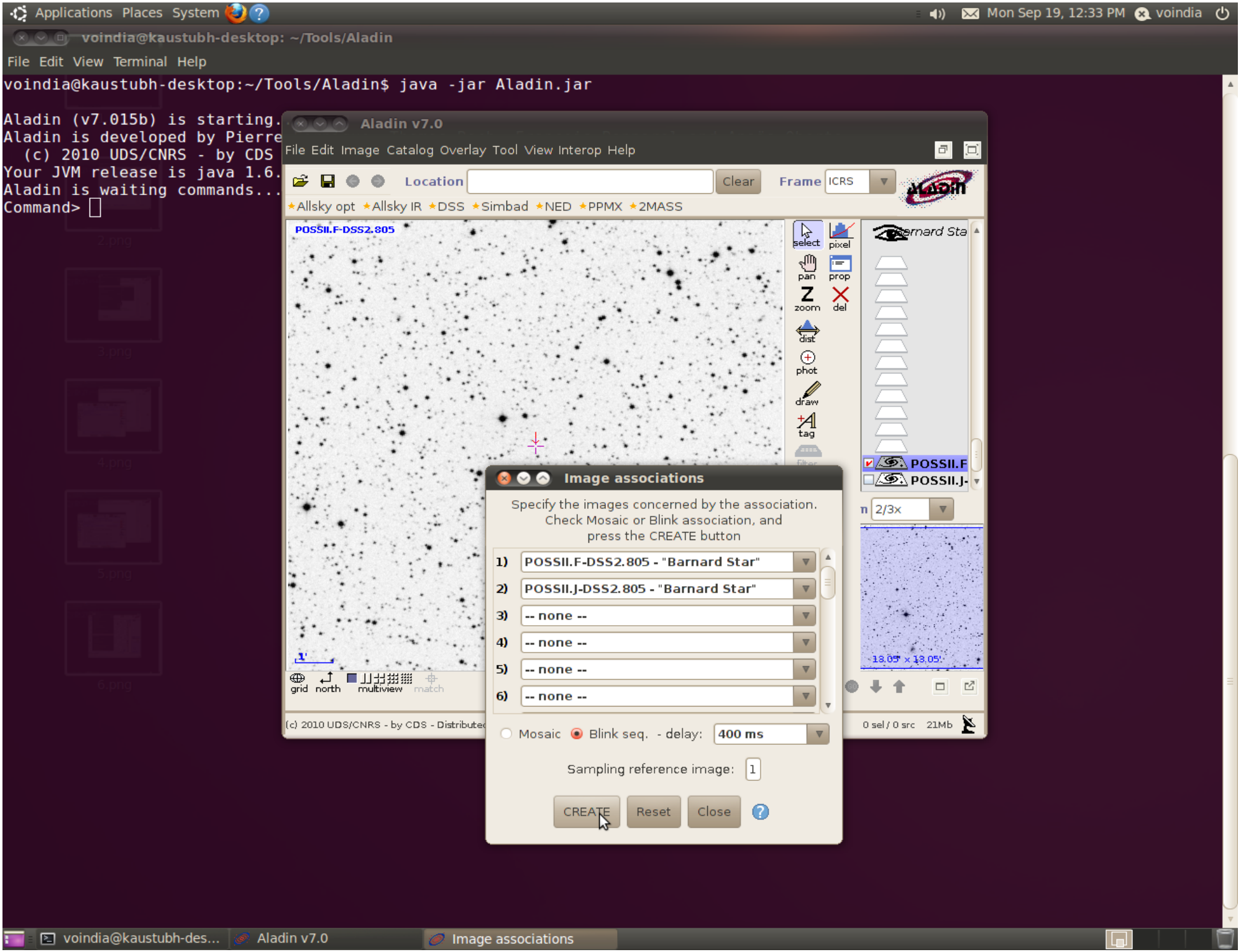
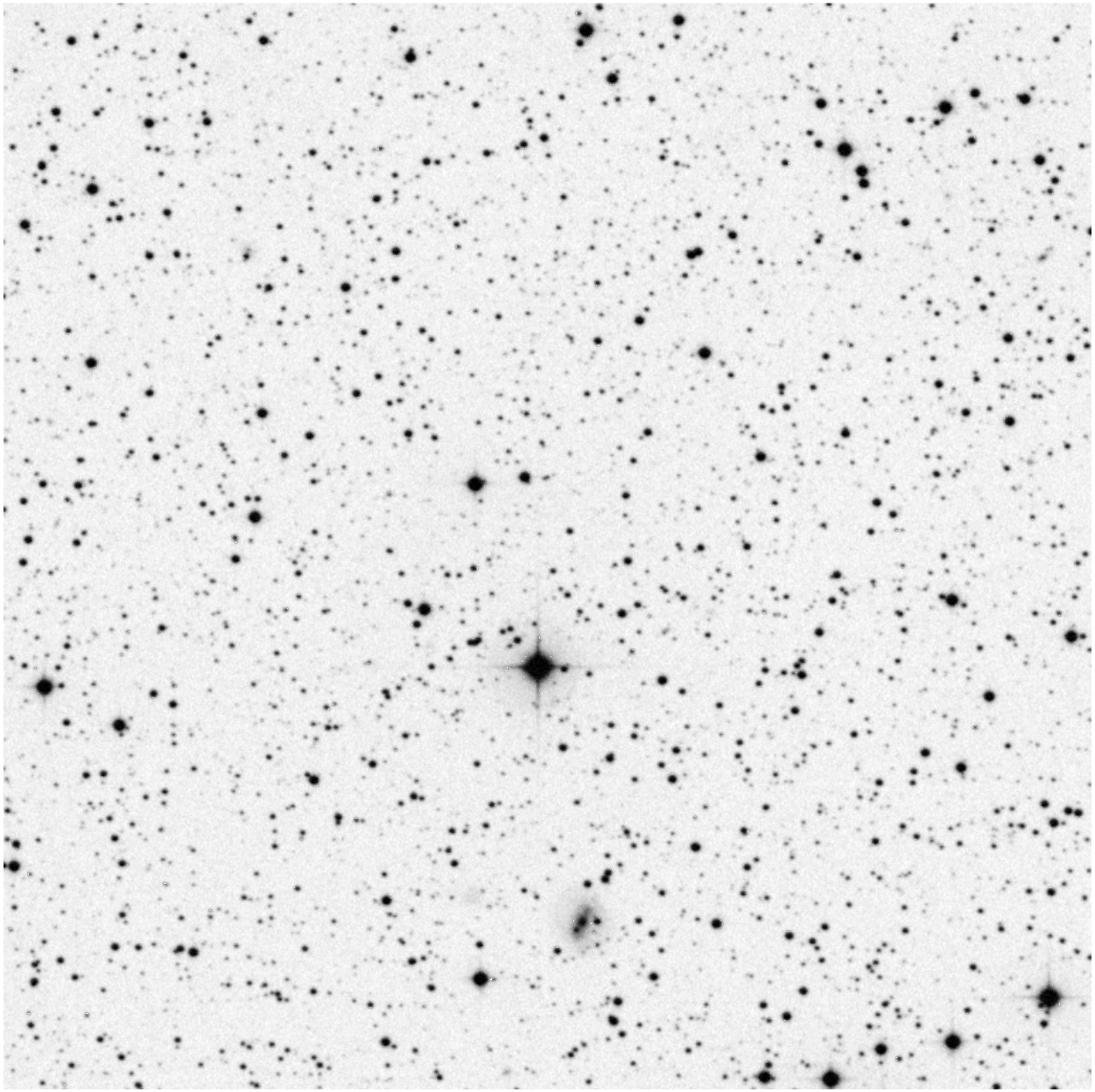
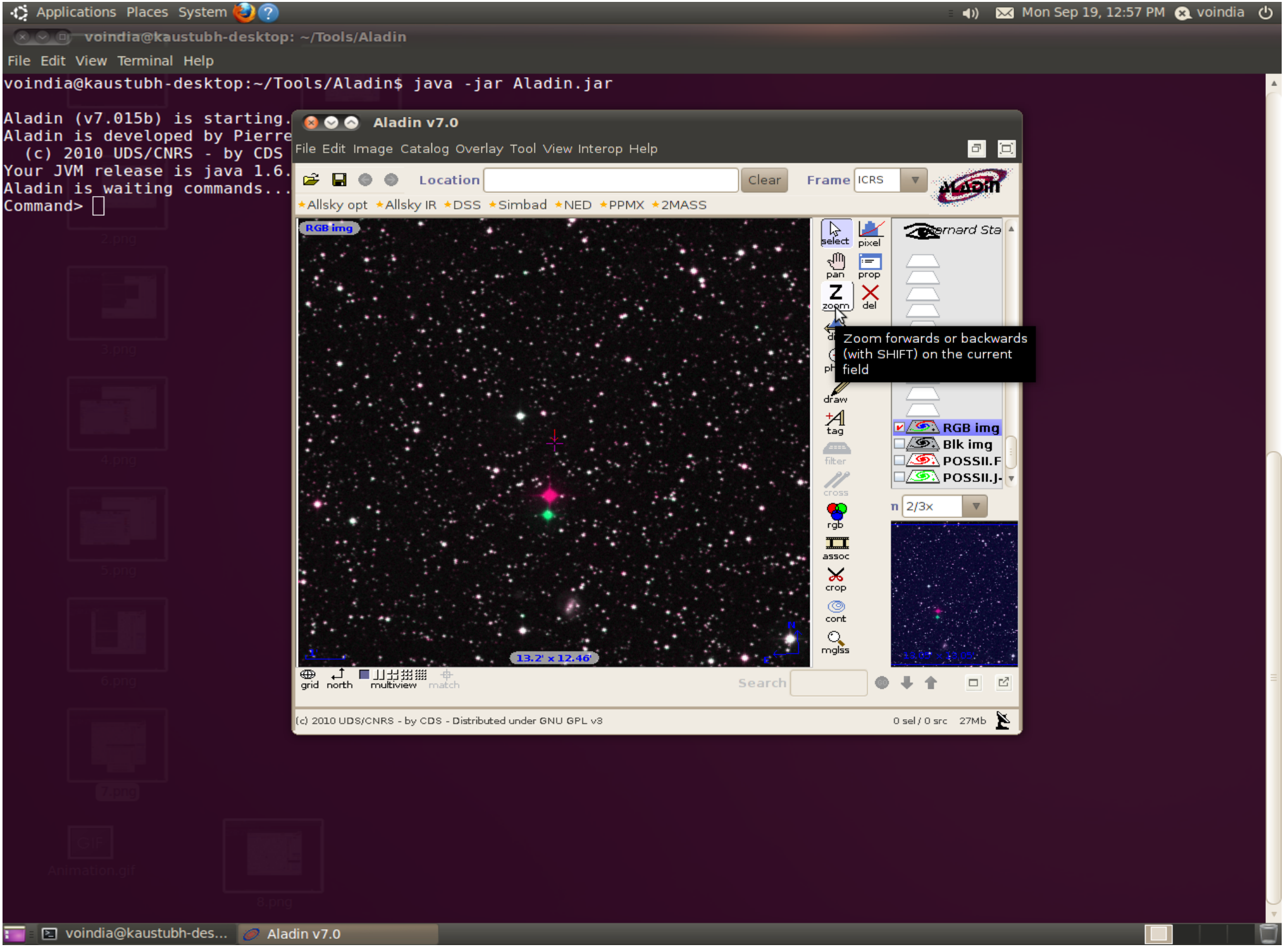
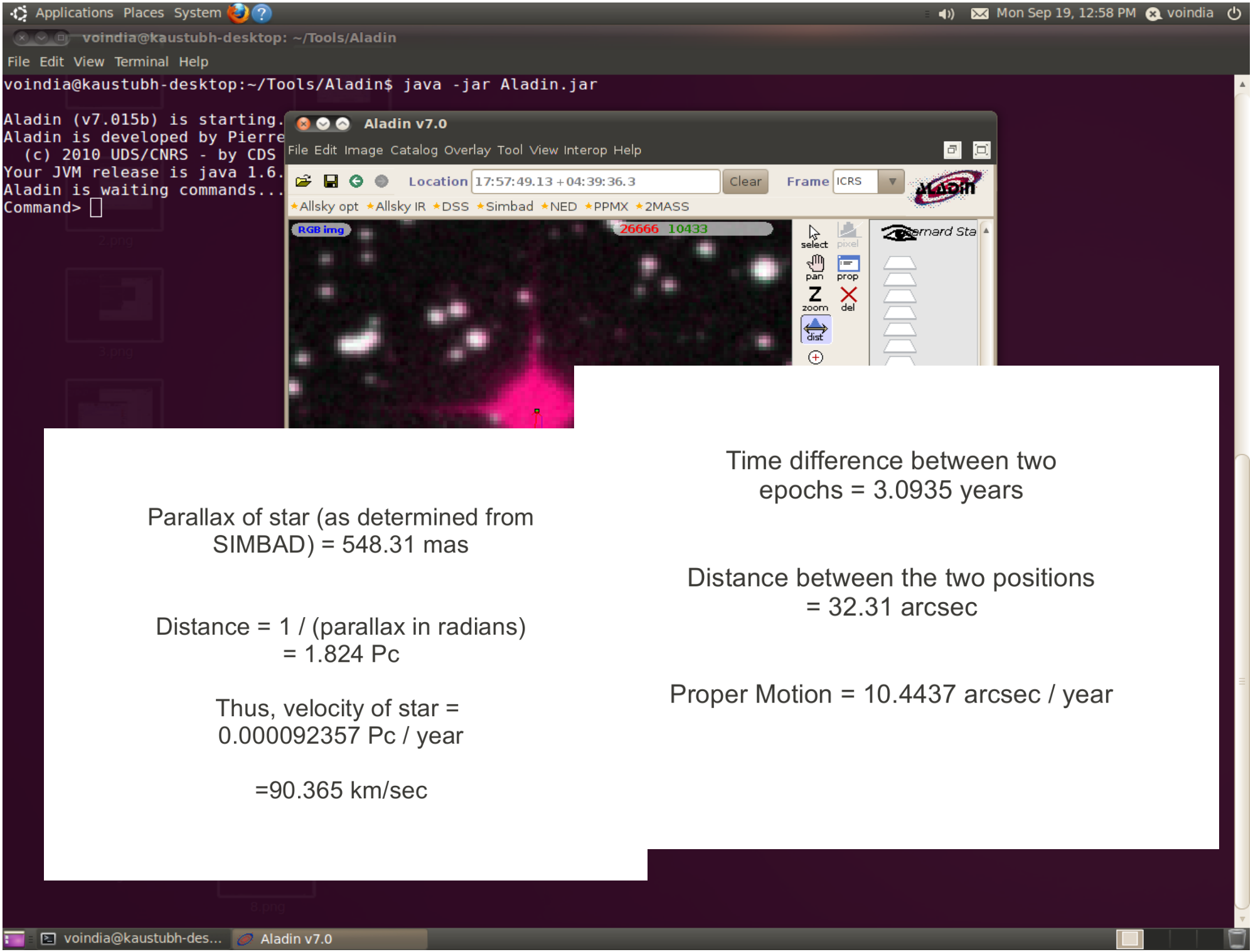
Command>
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
Server selector
Others
File
Allsky
allVO
FOV
Sextractor
Watch
Image servers
Catalog servers
Aladin image server
Step 1: Specify a target/radius and press SUBMIT
Target (ICRS, name)
Barnard Star
Search cone
0 arcmin
>>> Step 2: load one or several images
Hierarchical view
0-DSS2
569 13.0' x 13.0' 1950-07-09T07:40:12
569-PLATE 6.5° x 6.5° 1950-07-09T07:40:12
POSSII
F-DSS2
805 13.1' x 13.1' 1991-06-16T07:48:00
805-PLATE 6.6° x 6.6° 1991-06-16T07:48:00
J-DSS2
805 13.1' x 13.1' 1988-05-12T09:54:00
805-PLATE 6.6° x 6.6° 1988-05-12T09:54:00
2MASS
H
000528N HI1010209 8.6' x 17.1' 1997-05-28T10:16:50
Default image format: JPEG FITS
Reset
Clear
SUBMIT
Close
Submit your request
Search
0 sel / 0 src 15Mb
voindia@kaustubh-des...
Aladin v7.0
Server selector


Applications Places System
Thu Sep 22, 9:56 AM voindia
voindia@kaustubh-desktop: ~/Tools/Aladin
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
voindia@kaustubh-desktop:~$ cd Tools/Ala
voindia@kaustubh-desktop:~/Tools/Aladin$
Aladin (v7.015b) is starting...
Aladin is developed by Pierre Fernique,
(c) 2010 UDS/CNRS - by CDS - Distribut
Your JVM release is java 1.6.0_20 / Sun
Aladin is waiting commands...
Command> Exception in thread "AWT-EventQ
at java.awt.Container.getCompone
at javax.swing.JComponent.rectan
at javax.swing.JComponent.paint(
at javax.swing.JComponent.paintT
Server selector
Others
File
Allsky
all VO
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
Aladin image server
Step 1: Specify a target/radius and pr
Target (ICRS, name)
barnard star
Search cone
0 arcmin
>>> Step 2: load one or several images
POSSII
F-DSS2
805 13.1' x 13.1' 1991-06-16T07
805-PLATE 6.6° x 6.6° 1991-06-1
J-DSS2
805 13.1' x 13.1' 1988-05-12T09
805-PLATE 6.6° x 6.6° 1988-05-1
2MASS
H
000528N_HI1010209 8.6' x 17.1'
K
000528N_KI1010209 8.6' x 17.1'
J
Default image format: JPEG FITS
Reset
Clear
SUBMIT
Close
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame
ICRS
Allsky opt
Allsky IR
DSS
Simbad
NED
PPMX
2MASS
POSSII.F-DSS2.805
select
pixel
pan
prop
zoom
del
dist
phot
draw
tag
filter
cross
rgb
assoc
crop
cont
mglss
POSSII.J-
POSSII.F
2/3x
13.2' x 12.46'
grid
north
multiview
match
Search
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
0 sel / 0 src
13Mb
voindia@kaustubh-des...
Aladin v7.0
Server selector


Applications Places System
Mon Sep 19, 12:33 PM voindia
voindia@kaustubh-desktop: ~/Tools/Aladin
File Edit View Terminal Help
voindia@kaustubh-desktop:~/Tools/Aladin$ java -jar Aladin.jar
Aladin (v7.015b) is starting.
Aladin is developed by Pierre
(c) 2010 UDS/CNRS - by CDS
Your JVM release is java 1.6.
Aladin is waiting commands...
Command>
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame
ICRS
Allsky opt
Allsky IR
DSS
Simbad
NED
PPMX
2MASS
POSSII.F-DSS2.805
select
pixel
pan
prop
zoom
del
dist
phot
draw
tag
grid
north
multiview
match
POSSII.F
POSSII.J-
2/3x
13.05' x 13.05'
(c) 2010 UDS/CNRS - by CDS - Distribute
0 sel / 0 src
21Mb
Image associations
Specify the images concerned by the association.
Check Mosaic or Blink association, and
press the CREATE button
1) POSSII.F-DSS2.805 - "Barnard Star"
2) POSSII.J-DSS2.805 - "Barnard Star"
3) -- none --
4) -- none --
5) -- none --
6) -- none --
Mosaic
Blink seq.
- delay:
400 ms
Sampling reference image:
1
CREATE
Reset
Close
voindia@kaustubh-des...
Aladin v7.0
Image associations




Applications Places System
Mon Sep 19, 12:57 PM voindia
voindia@kaustubh-desktop: ~/Tools/Aladin
File Edit View Terminal Help
voindia@kaustubh-desktop:~/Tools/Aladin$ java -jar Aladin.jar
Aladin (v7.015b) is starting.
Aladin is developed by Pierre
(c) 2010 UDS/CNRS - by CDS
Your JVM release is java 1.6.
Aladin is waiting commands...
Command>
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame
ICRS
Allsky opt
Allsky IR
DSS
Simbad
NED
PPMX
2MASS
RGB img
13.2' x 12.46'
select
pixel
pan
prop
zoom
del
draw
tag
filter
cross
rgb
assoc
crop
cont
mglss
Zoom forwards or backwards (with SHIFT) on the current field
RGB img
Blk img
POSSII.F
POSSII.J-
2/3x
grid
north
multiview
match
Search
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
0 sel / 0 src
27Mb
voindia@kaustubh-des...
Aladin v7.0



Parallax of star (as determined from SIMBAD) = 548.31 mas

Distance = 1 / (parallax in radians)
= 1.824 Pc

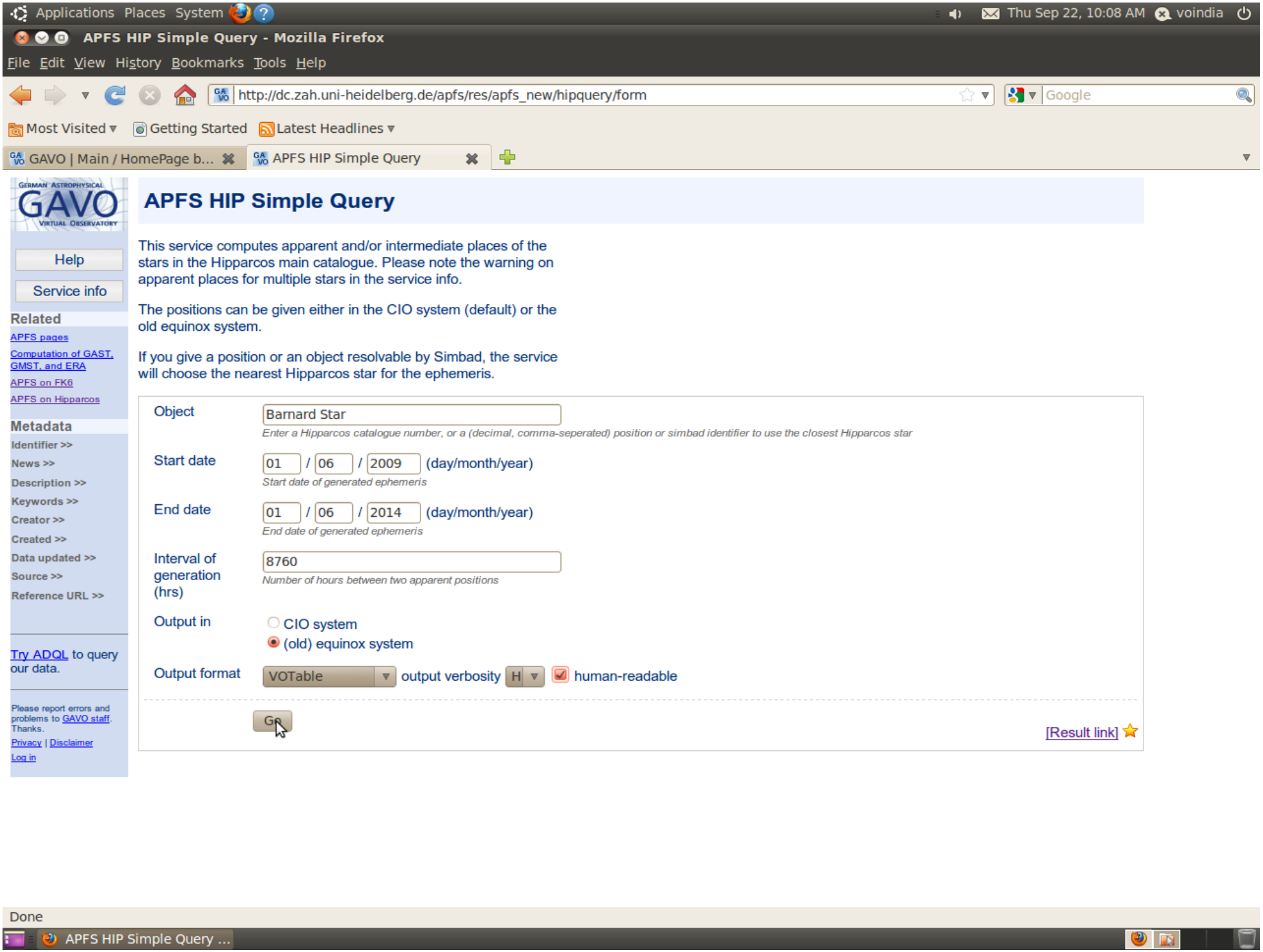
Thus, velocity of star =
0.000092357 Pc / year

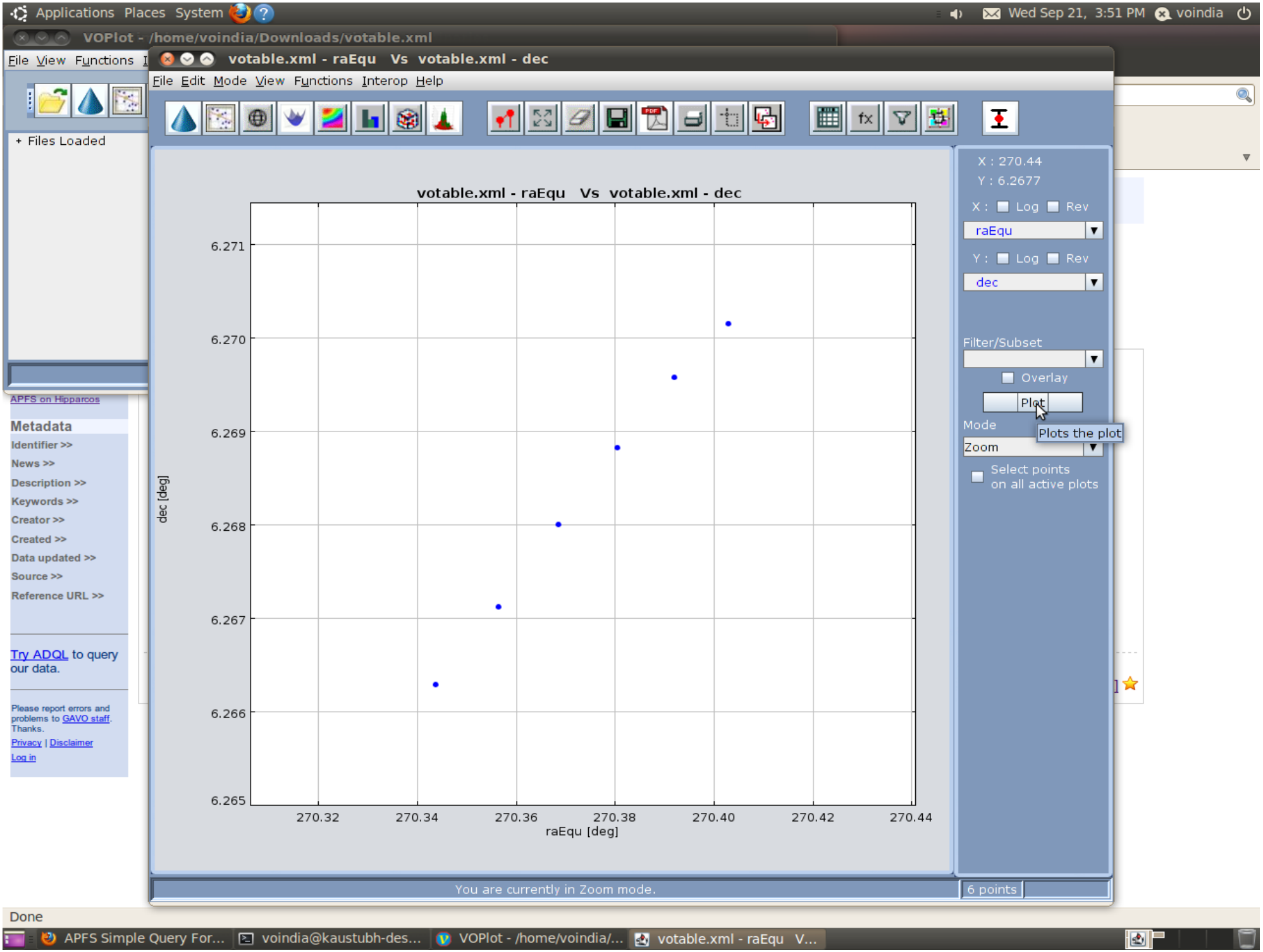
=90.365 km/sec

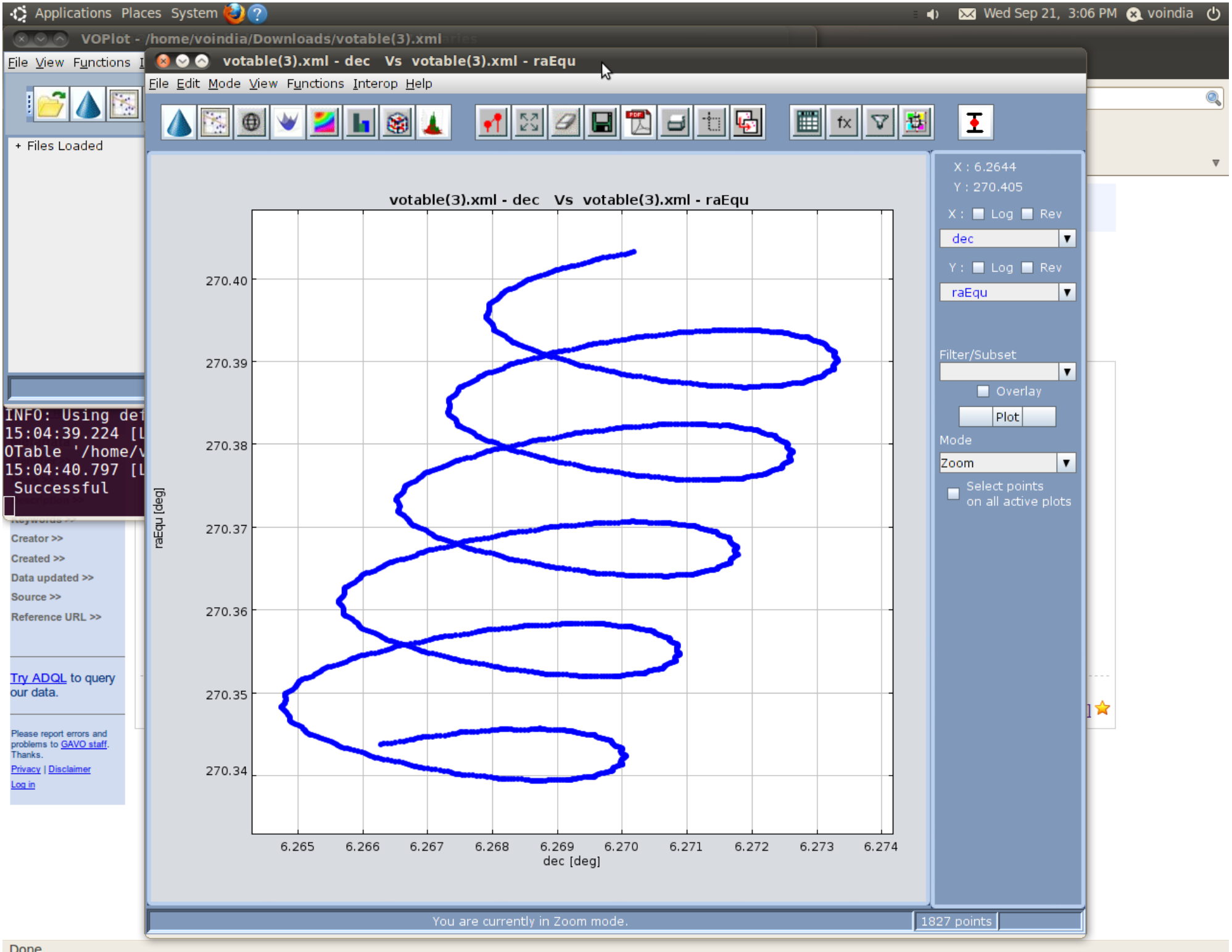
Time difference between two epochs = 3.0935 years

Distance between the two positions
= 32.31 arcsec

Proper Motion = 10.4437 arcsec / year


Applications Places System
Thu Sep 22, 10:08 AM voindia
APFS HIP Simple Query - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://dc.zah.uni-heidelberg.de/apfs/res/apfs_new/hipquery/form
Google
Most Visited
Getting Started
Latest Headlines
GAVO | Main / HomePage b...
APFS HIP Simple Query
GERMAN ASTROPHYSICAL VIRTUAL OBSERVATORY
Help
Service info
Related
APFS pages
Computation of GAST, GMST, and ERA
APFS on FK6
APFS on Hipparcos
Metadata
Identifier >>
News >>
Description >>
Keywords >>
Creator >>
Created >>
Data updated >>
Source >>
Reference URL >>
Try ADQL to query our data.
Please report errors and problems to GAVO staff. Thanks.
Privacy | Disclaimer
Log in
APFS HIP Simple Query
This service computes apparent and/or intermediate places of the stars in the Hipparcos main catalogue. Please note the warning on apparent places for multiple stars in the service info.
The positions can be given either in the CIO system (default) or the old equinox system.
If you give a position or an object resolvable by Simbad, the service will choose the nearest Hipparcos star for the ephemeris.
Object
Barnard Star
Enter a Hipparcos catalogue number, or a (decimal, comma-seperated) position or simbad identifier to use the closest Hipparcos star
Start date
01 / 06 / 2009 (day/month/year)
Start date of generated ephemeris
End date
01 / 06 / 2014 (day/month/year)
End date of generated ephemeris
Interval of generation (hrs)
8760
Number of hours between two apparent positions
Output in
CIO system
(old) equinox system
Output format
VOTable
output verbosity
H
human-readable
Go
[Result link]
Done
APFS HIP Simple Query ...

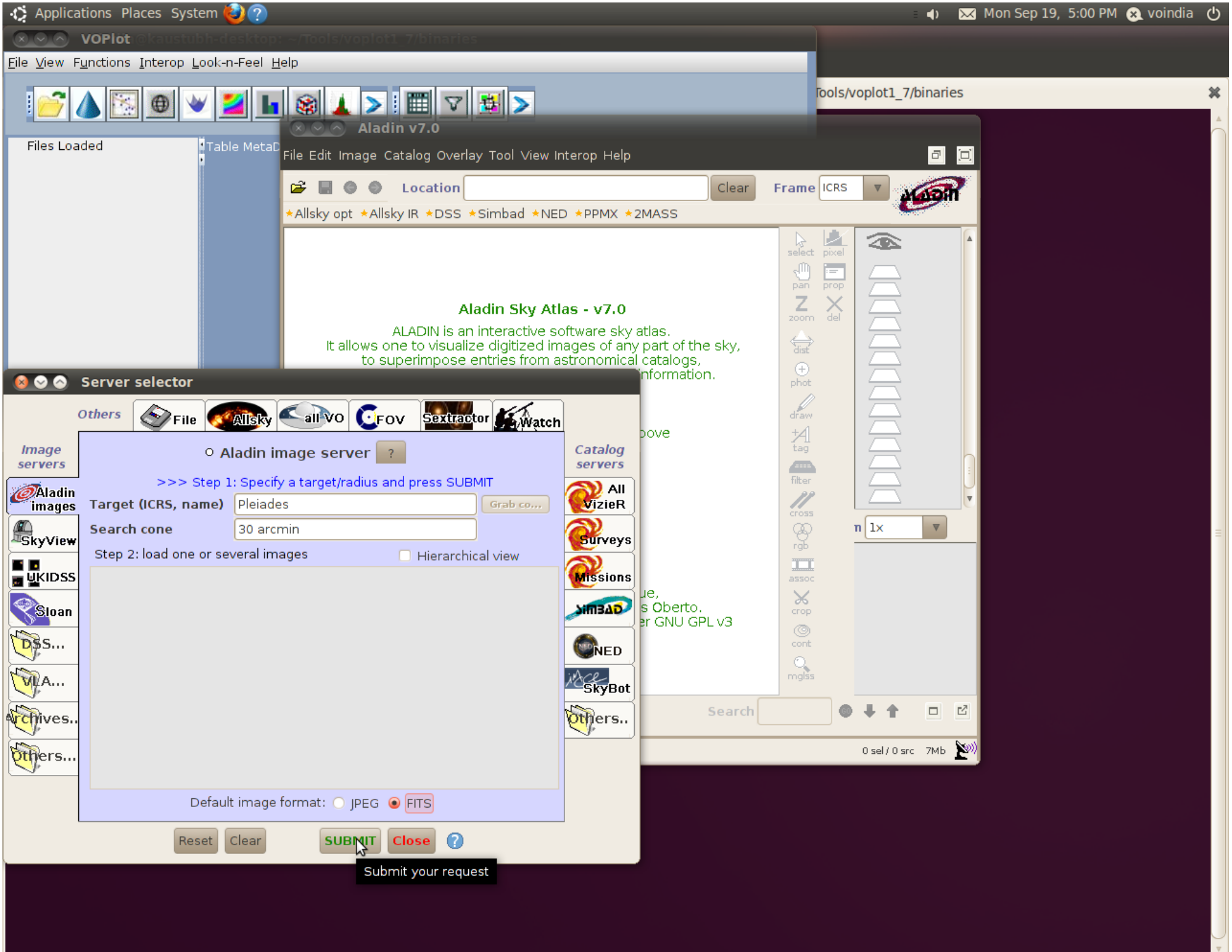

Applications Places System
Wed Sep 21, 3:51 PM voindia
VOPlot - /home/voindia/Downloads/votable.xml
File View Functions
votable.xml - raEqu Vs votable.xml - dec
File Edit Mode View Functions Interop Help
+ Files Loaded
votable.xml - raEqu Vs votable.xml - dec
dec [deg]
raEqu [deg]
6.271
6.270
6.269
6.268
6.267
6.266
6.265
270.32
270.34
270.36
270.38
270.40
270.42
270.44
X : 270.44
Y : 6.2677
X : Log Rev
raEqu
Y : Log Rev
dec
Filter/Subset
Overlay
Plot
Plots the plot
Mode
Zoom
Select points on all active plots
You are currently in Zoom mode.
6 points
APFS on Hipparcos
Metadata
Identifier >>
News >>
Description >>
Keywords >>
Creator >>
Created >>
Data updated >>
Source >>
Reference URL >>
Try ADQL to query our data.
Please report errors and problems to GAVO staff. Thanks.
Privacy | Disclaimer
Log in
Done
APFS Simple Query For...
voindia@kaustubh-des...
VOPlot - /home/voindia/...
votable.xml - raEqu V...

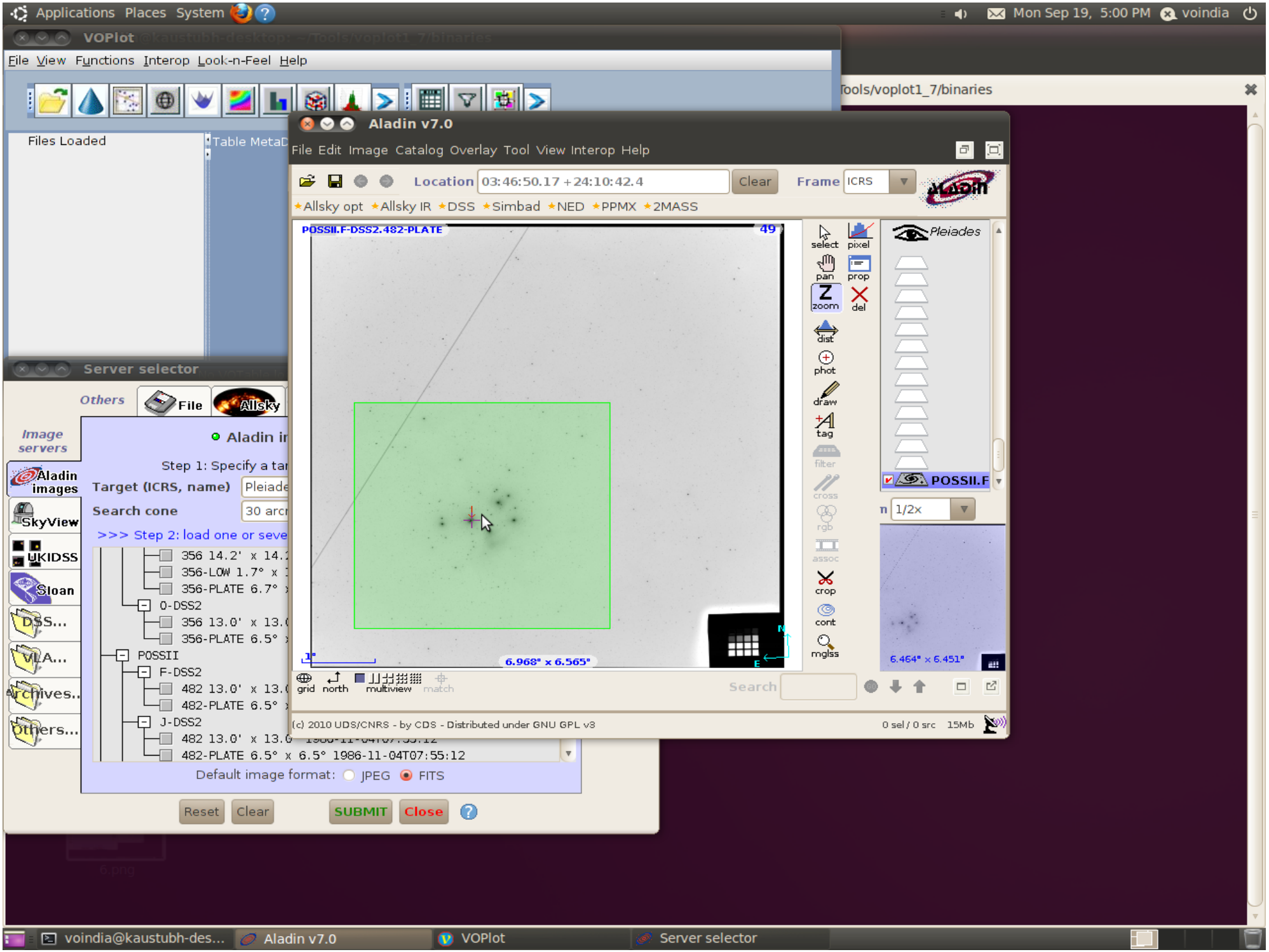

Applications Places System
Wed Sep 21, 3:06 PM voindia
VOPlot - /home/voindia/Downloads/votable(3).xml
File View Functions
votable(3).xml - dec Vs votable(3).xml - raEqu
File Edit Mode View Functions Interop Help
+ Files Loaded
INFO: Using def
15:04:39.224 [L
OTable '/home/v
15:04:40.797 [L
Successful
votable(3).xml - dec Vs votable(3).xml - raEqu
raEqu [deg]
dec [deg]
270.40
270.39
270.38
270.37
270.36
270.35
270.34
6.265
6.266
6.267
6.268
6.269
6.270
6.271
6.272
6.273
6.274
X : 6.2644
Y : 270.405
X : Log Rev
dec
Y : Log Rev
raEqu
Filter/Subset
Overlay
Plot
Mode
Zoom
Select points on all active plots
You are currently in Zoom mode.
1827 points
Creator >>
Created >>
Data updated >>
Source >>
Reference URL >>
Try ADQL to query our data.
Please report errors and problems to GAVO staff. Thanks.
Privacy | Disclaimer
Log in
Done

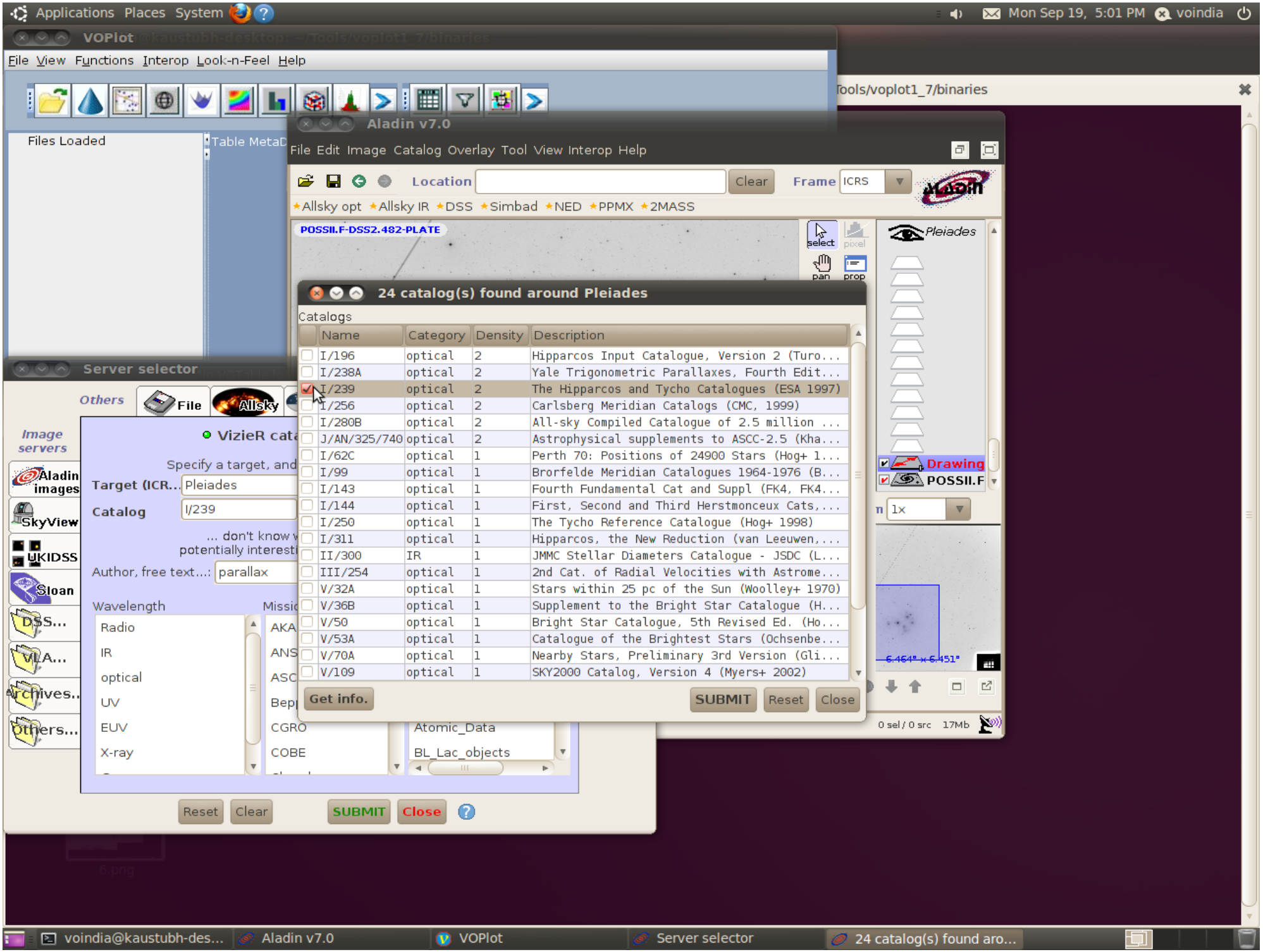
The Pleiades Cluster

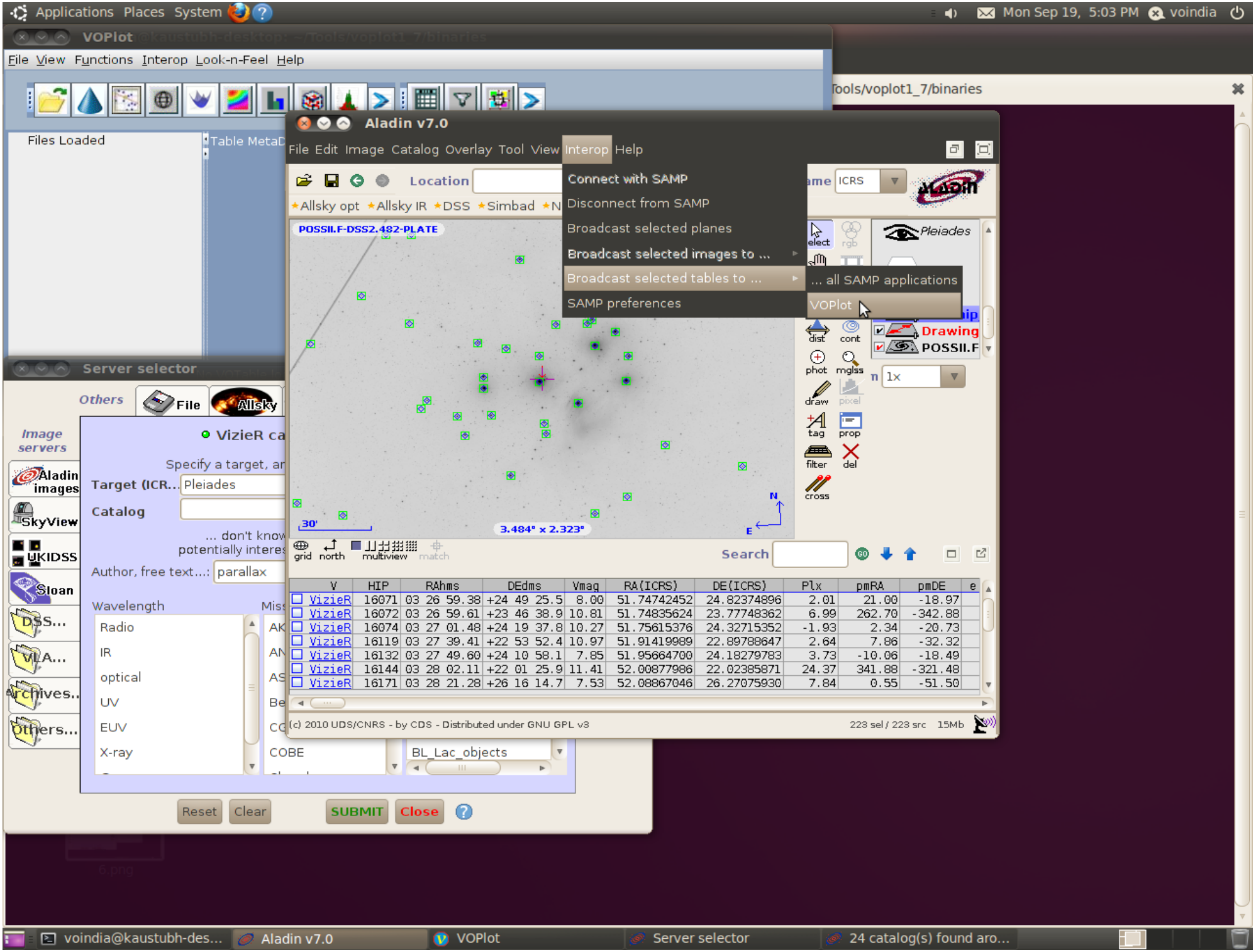
The Pleiades

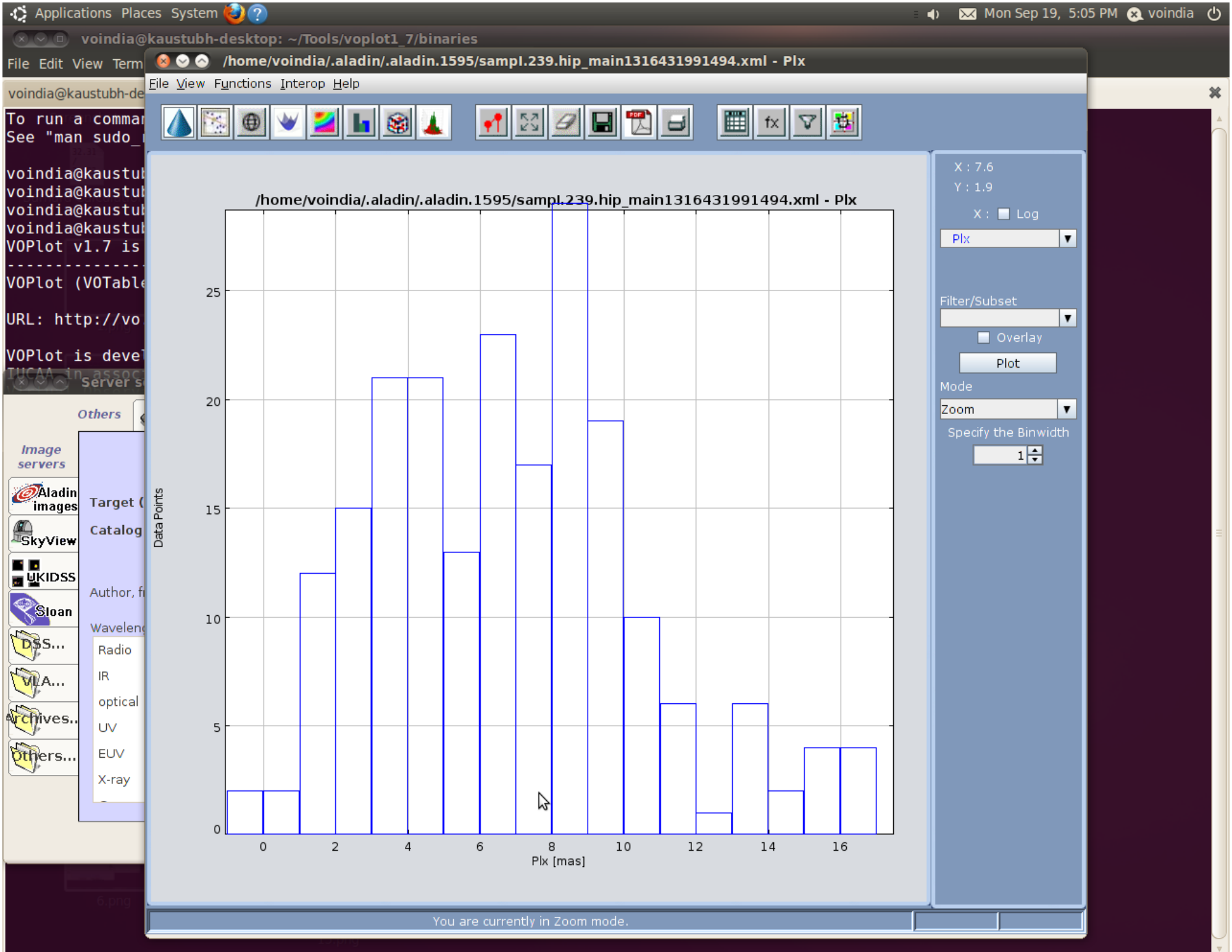
Open star cluster, dominated by hot, blue extremely luminous stars formed ~10^8 yr ago.
Disatnce ~400 lyr

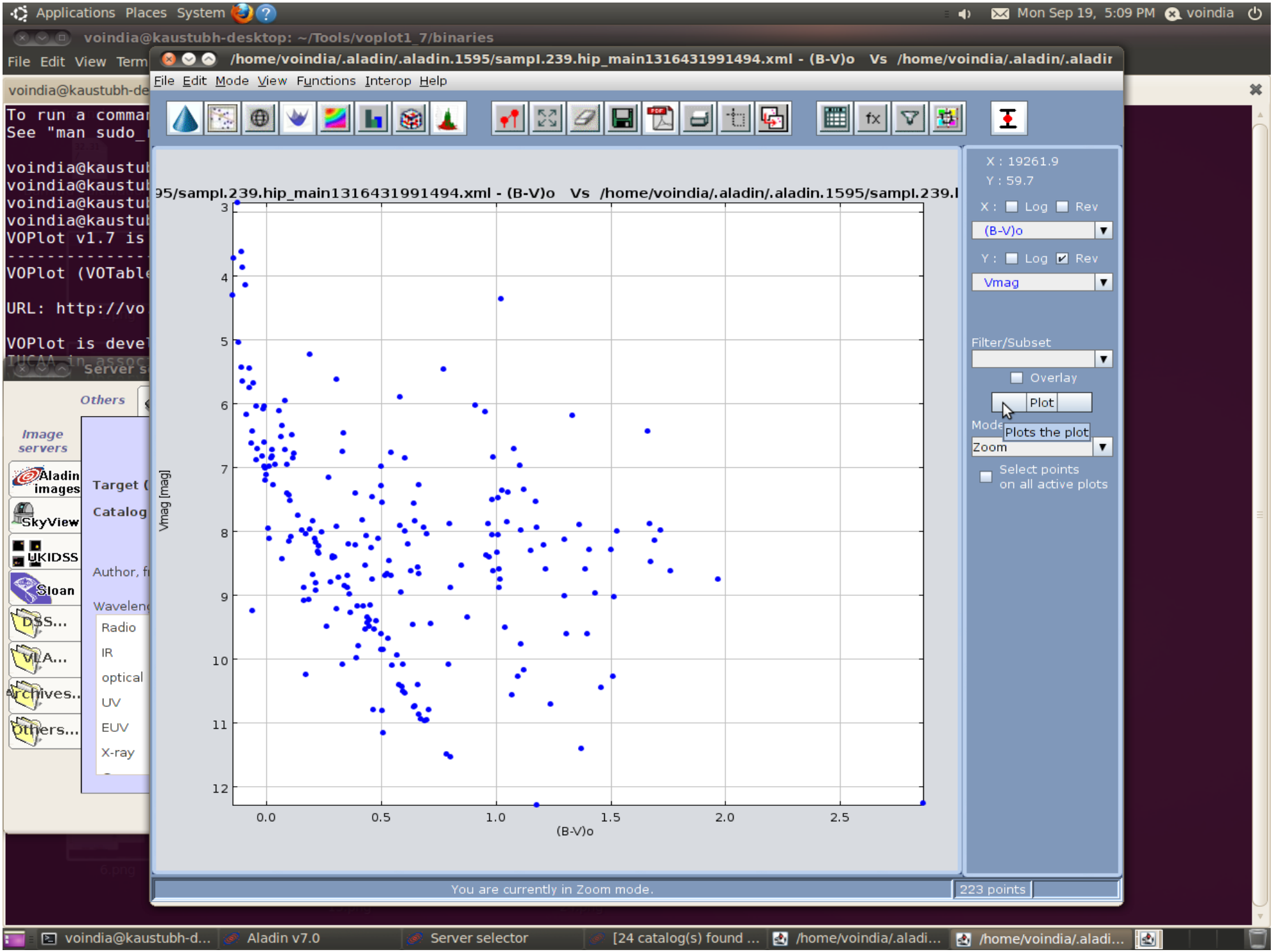

Applications Places System
Mon Sep 19, 5:00 PM voindia
VOPlot
File View Functions Interop Look-n-Feel Help
Files Loaded
Table MetaD
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
Aladin Sky Atlas - v7.0
ALADIN is an interactive software sky atlas.
It allows one to visualize digitized images of any part of the sky,
to superimpose entries from astronomical catalogs,
Server selector
Others
File
Allsky
all VO
FOV
Sextractor
Watch
Image servers
Catalog servers
Aladin image server
>>> Step 1: Specify a target/radius and press SUBMIT
Target (ICRS, name)
Pleiades
Search cone
30 arcmin
Step 2: load one or several images
Hierarchical view
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives..
Others...
All VizieR
Surveys
Missions
SIMBAD
NED
SkyBot
Others..
Default image format: JPEG FITS
Reset
Clear
SUBMIT
Close
Submit your request
Search
0 sel / 0 src 7Mb

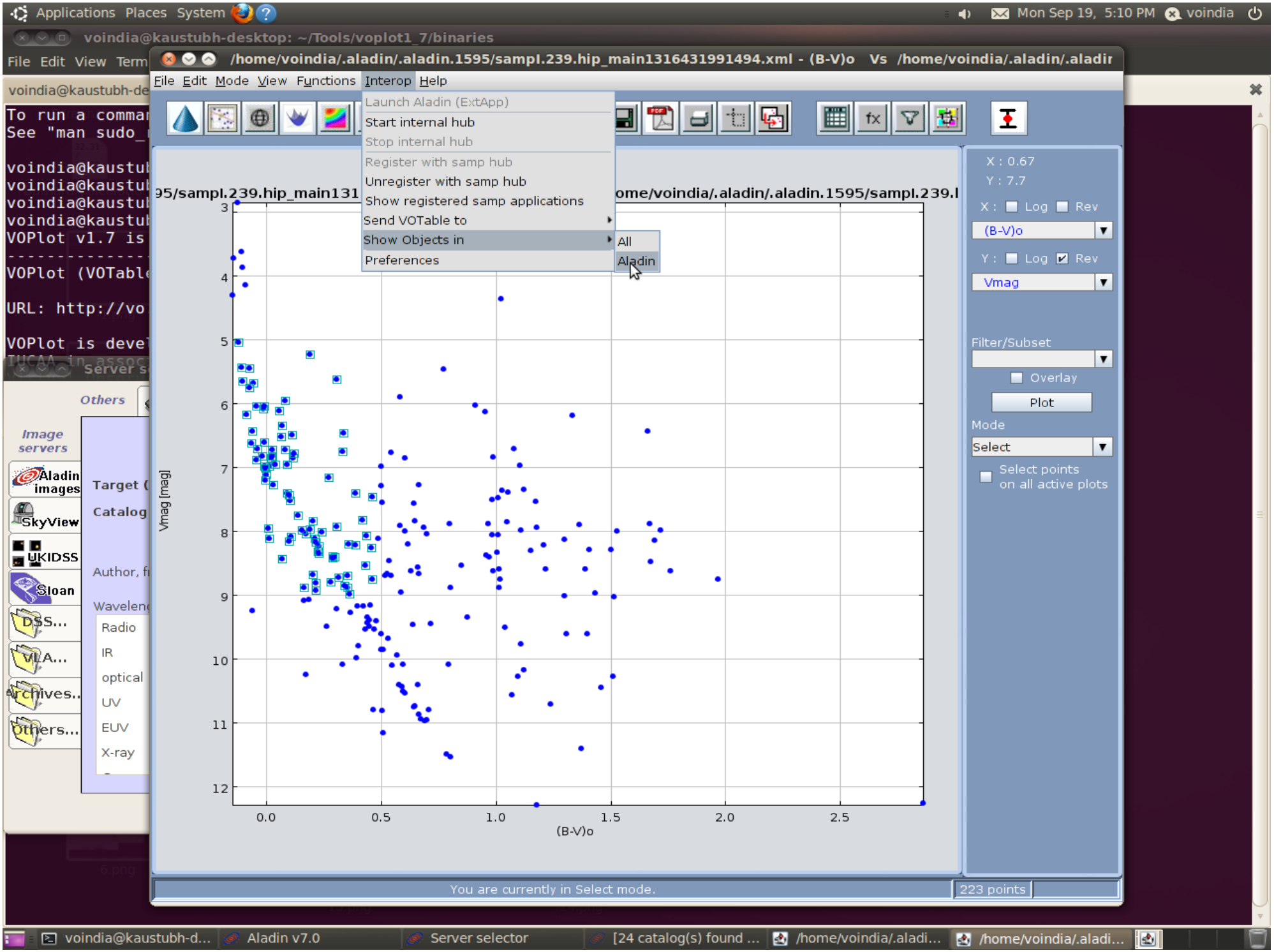

Applications Places System
Mon Sep 19, 5:00 PM voindia
VOPlot
File View Functions Interop Look-n-Feel Help
Files Loaded
Table MetaD
Tools/voplot1_7/binaries
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location 03:46:50.17 +24:10:42.4
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
POSSII.F-DSS2.482-PLATE
49
Pleiades
POSSII.F
6.968° x 6.565°
6.464° x 6.451°
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
0 sel / 0 src 15Mb
Server selector
Others
File
Allsky
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
Target (ICRS, name)
Search cone
>>> Step 2: load one or seve
356 14.2' x 14.
356-LOW 1.7° x
356-PLATE 6.7°
O-DSS2
356 13.0' x 13.
356-PLATE 6.5°
POSSII
F-DSS2
482 13.0' x 13.
482-PLATE 6.5°
J-DSS2
482 13.0' x 13.
482-PLATE 6.5° x 6.5° 1986-11-04T07:55:12
Default image format: JPEG FITS
Reset
Clear
SUBMIT
Close
voindia@kaustubh-des...
Aladin v7.0
VOPlot
Server selector

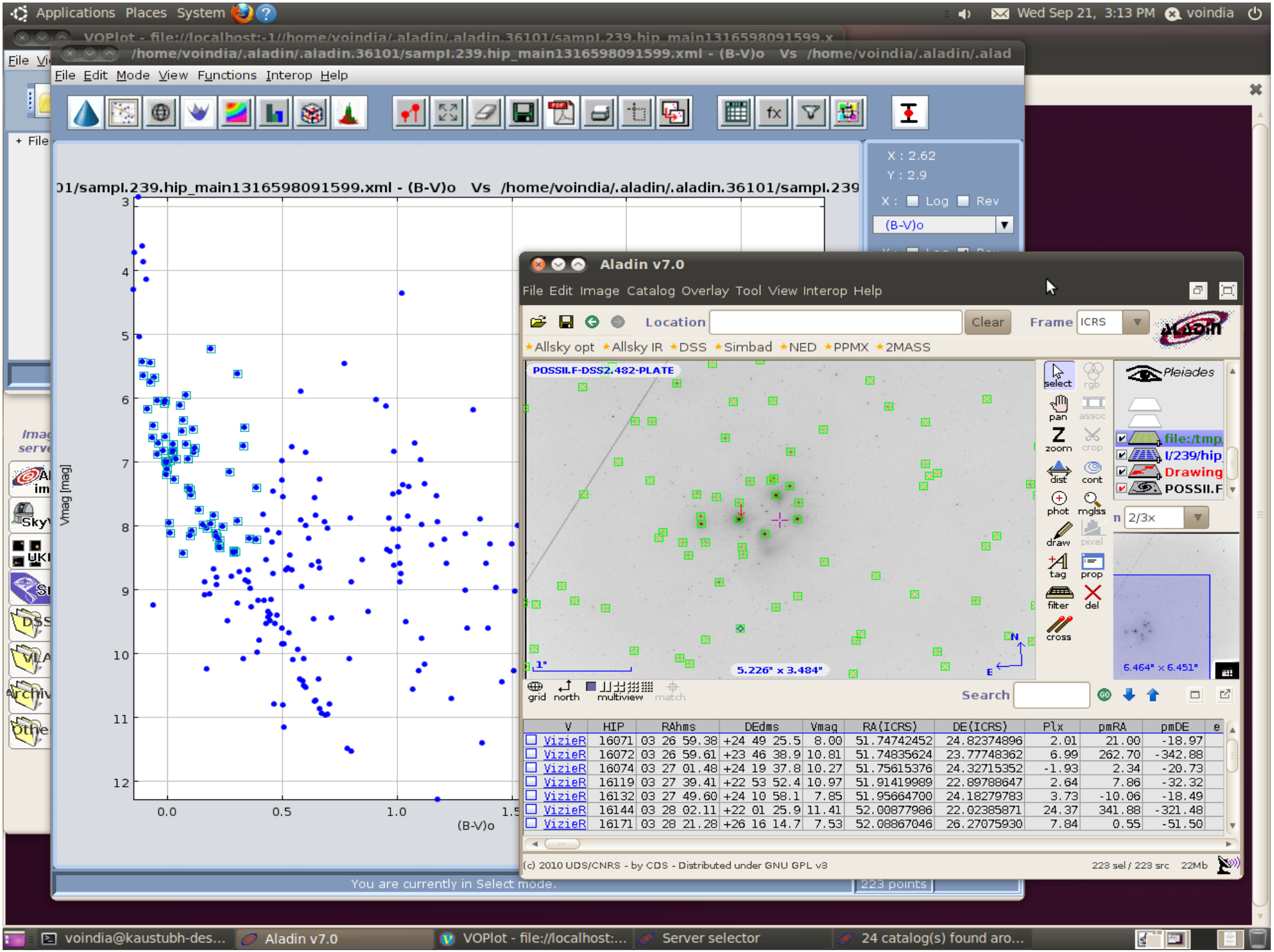

Applications Places System
Mon Sep 19, 5:01 PM voindia
VOPlot
File View Functions Interop Look-n-Feel Help
Files Loaded
Table MetaD
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
POSSII.F-DSS2.482-PLATE
select
pixel
pan
prop
Pleiades
Drawing
POSSII.F
1x
6.464° x 6.451°
0 sel / 0 src 17Mb
24 catalog(s) found around Pleiades
Catalogs
Name Category Density Description
I/196 optical 2 Hipparcos Input Catalogue, Version 2 (Turo...
I/238A optical 2 Yale Trigonometric Parallaxes, Fourth Edit...
I/239 optical 2 The Hipparcos and Tycho Catalogues (ESA 1997)
I/256 optical 2 Carlsberg Meridian Catalogs (CMC, 1999)
I/280B optical 2 All-sky Compiled Catalogue of 2.5 million ...
J/AN/325/740 optical 2 Astrophysical supplements to ASCC-2.5 (Kha...
I/62C optical 1 Perth 70: Positions of 24900 Stars (Hog+ 1...
I/99 optical 1 Brorfelde Meridian Catalogues 1964-1976 (B...
I/143 optical 1 Fourth Fundamental Cat and Suppl (FK4, FK4...
I/144 optical 1 First, Second and Third Herstmonceux Cats,...
I/250 optical 1 The Tycho Reference Catalogue (Hog+ 1998)
I/311 optical 1 Hipparcos, the New Reduction (van Leeuwen,...
II/300 IR 1 JMMC Stellar Diameters Catalogue - JSDC (L...
III/254 optical 1 2nd Cat. of Radial Velocities with Astrome...
V/32A optical 1 Stars within 25 pc of the Sun (Woolley+ 1970)
V/36B optical 1 Supplement to the Bright Star Catalogue (H...
V/50 optical 1 Bright Star Catalogue, 5th Revised Ed. (Ho...
V/53A optical 1 Catalogue of the Brightest Stars (Ochsenbe...
V/70A optical 1 Nearby Stars, Preliminary 3rd Version (Gli...
V/109 optical 1 SKY2000 Catalog, Version 4 (Myers+ 2002)
Get info.
SUBMIT
Reset
Close
Server selector
Others
File
Allsky
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
VizieR cata
Specify a target, and
Target (ICR...
Pleiades
Catalog
I/239
... don't know
potentially interesti
Author, free text...:
parallax
Wavelength
Radio
IR
optical
UV
EUV
X-ray
AKA
ANS
ASC
Bep
CGRO
COBE
Atomic_Data
BL_Lac_objects
Reset
Clear
SUBMIT
Close
voindia@kaustubh-des...
Aladin v7.0
VOPlot
Server selector
24 catalog(s) found aro...

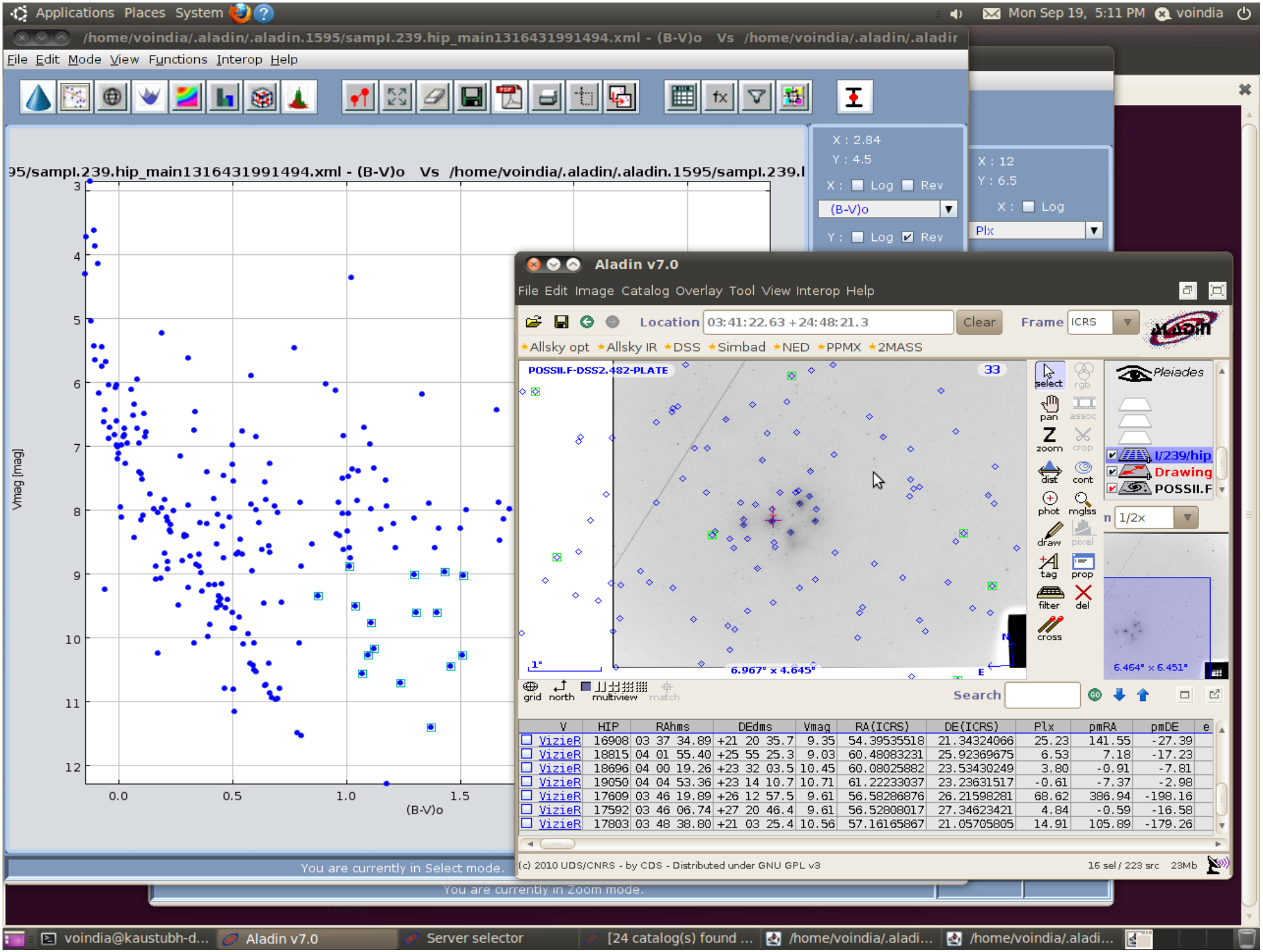

Applications Places System
Mon Sep 19, 5:03 PM voindia
VOPlot
File View Functions Interop Look-n-Feel Help
Files Loaded
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Allsky opt Allsky IR DSS Simbad
POSSII.F-DSS2.482-PLATE
Connect with SAMP
Disconnect from SAMP
Broadcast selected planes
Broadcast selected images to ...
Broadcast selected tables to ...
SAMP preferences
... all SAMP applications
VOPlot
Pleiades
Drawing
POSSII.F
3.484° x 2.323°
Search
Server selector
Others
File
Allsky
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
VizieR ca
Specify a target, ar
Target (ICR... Pleiades
Catalog
... don't know
potentially interes
Author, free text...: parallax
Wavelength
Radio
IR
optical
UV
EUV
X-ray
COBE
BL_Lac_objects
Reset
Clear
SUBMIT
Close
V HIP RAhms DEdms Vmag RA(ICRS) DE(ICRS) Plx pmRA pmDE
VizieR 16071 03 26 59.38 +24 49 25.5 8.00 51.74742452 24.82374896 2.01 21.00 -18.97
VizieR 16072 03 26 59.61 +23 46 38.9 10.81 51.74835624 23.77748362 6.99 262.70 -342.88
VizieR 16074 03 27 01.48 +24 19 37.8 10.27 51.75615376 24.32715352 -1.93 2.34 -20.73
VizieR 16119 03 27 39.41 +22 53 52.4 10.97 51.91419989 22.89788647 2.64 7.86 -32.32
VizieR 16132 03 27 49.60 +24 10 58.1 7.85 51.95664700 24.18279783 3.73 -10.06 -18.49
VizieR 16144 03 28 02.11 +22 01 25.9 11.41 52.00877986 22.02385871 24.37 341.88 -321.48
VizieR 16171 03 28 21.28 +26 16 14.7 7.53 52.08867046 26.27075930 7.84 0.55 -51.50
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
223 sel / 223 src 15Mb
voindia@kaustubh-des...
Aladin v7.0
VOPlot
Server selector
24 catalog(s) found aro...


Applications Places System
Mon Sep 19, 5:05 PM voindia
voindia@kaustubh-desktop: ~/Tools/voplot1_7/binaries
File Edit View Term
/home/voindia/.aladin/.aladin.1595/sampl.239.hip_main1316431991494.xml - Plx
File View Functions Interop Help
/home/voindia/.aladin/.aladin.1595/sampl.239.hip_main1316431991494.xml - Plx
Data Points
Plx [mas]
0
5
10
15
20
25
0
2
4
6
8
10
12
14
16
X : 7.6
Y : 1.9
X : Log
Plx
Filter/Subset
Overlay
Plot
Mode
Zoom
Specify the Binwidth
1
You are currently in Zoom mode.
Others
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
Target (
Catalog
Author, fi
Wavelenc
Radio
IR
optical
UV
EUV
X-ray


Applications Places System
Mon Sep 19, 5:09 PM voindia
voindia@kaustubh-desktop: ~/Tools/voplot1_7/binaries
File Edit View Term
/home/voindia/.aladin/.aladin.1595/sampl.239.hip_main1316431991494.xml - (B-V)o Vs /home/voindia/.aladin/.aladir
File Edit Mode View Functions Interop Help
95/sampl.239.hip_main1316431991494.xml - (B-V)o Vs /home/voindia/.aladin/.aladin.1595/sampl.239.l
Vmag [mag]
(B-V)o
X : 19261.9
Y : 59.7
X : Log Rev
(B-V)o
Y : Log Rev
Vmag
Filter/Subset
Overlay
Plot
Plots the plot
Mode
Zoom
Select points on all active plots
You are currently in Zoom mode.
223 points
Others
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
Target (
Catalog
Author, fi
Wavelen
Radio
IR
optical
UV
EUV
X-ray
voindia@kaustubh-d...
Aladin v7.0
Server selector
[24 catalog(s) found ...
/home/voindia/.aladi...
/home/voindia/.aladi...


Applications Places System
Mon Sep 19, 5:10 PM voindia
voindia@kaustubh-desktop: ~/Tools/voplot1_7/binaries
File Edit View Term
/home/voindia/.aladin/.aladin.1595/sampl.239.hip_main1316431991494.xml - (B-V)o Vs /home/voindia/.aladin/.aladir
File Edit Mode View Functions Interop Help
Launch Aladin (ExtApp)
Start internal hub
Stop internal hub
Register with samp hub
Unregister with samp hub
Show registered samp applications
Send VOTable to
Show Objects in
Preferences
All
Aladin
X : 0.67
Y : 7.7
X : Log Rev
(B-V)o
Y : Log Rev
Vmag
Filter/Subset
Overlay
Plot
Mode
Select
Select points on all active plots
Vmag [mag]
(B-V)o
You are currently in Select mode.
223 points
Others
Image servers
Aladin images
SkyView
UKIDSS
Sloan
DSS...
VLA...
Archives...
Others...
Target (
Catalog
Author, fi
Wavelen
Radio
IR
optical
UV
EUV
X-ray
voindia@kaustubh-d...
Aladin v7.0
Server selector
[24 catalog(s) found ...
/home/voindia/.aladi...
/home/voindia/.aladi...


Applications Places System
Wed Sep 21, 3:13 PM voindia
/home/voindia/.aladin/.aladin.36101/sampl.239.hip_main1316598091599.xml - (B-V)o Vs /home/voindia/.alad
File Edit Mode View Functions Interop Help
X : 2.62
Y : 2.9
X : Log Rev
(B-V)o
Vmag [mag]
(B-V)o
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
POSSII.F-DSS2.482-PLATE
5.226° x 3.484°
6.464° x 6.451°
Pleiades
Search
V HIP RAhms DEdms Vmag RA(ICRS) DE(ICRS) Plx pmRA pmDE e
VizieR 16071 03 26 59.38 +24 49 25.5 8.00 51.74742452 24.82374896 2.01 21.00 -18.97
VizieR 16072 03 26 59.61 +23 46 38.9 10.81 51.74835624 23.77748362 6.99 262.70 -342.88
VizieR 16074 03 27 01.48 +24 19 37.8 10.27 51.75615376 24.32715352 -1.93 2.34 -20.73
VizieR 16119 03 27 39.41 +22 53 52.4 10.97 51.91419989 22.89788647 2.64 7.86 -32.32
VizieR 16132 03 27 49.60 +24 10 58.1 7.85 51.95664700 24.18279783 3.73 -10.06 -18.49
VizieR 16144 03 28 02.11 +22 01 25.9 11.41 52.00877986 22.02385871 24.37 341.88 -321.48
VizieR 16171 03 28 21.28 +26 16 14.7 7.53 52.08867046 26.27075930 7.84 0.55 -51.50
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
223 sel / 223 src 22Mb
You are currently in Select mode.
223 points
voindia@kaustubh-des...
Aladin v7.0
VOPlot - file://localhost:...
Server selector
24 catalog(s) found aro...


Applications Places System
Mon Sep 19, 5:11 PM voindia
/home/voindia/.aladin/.aladin.1595/sampl.239.hip_main1316431991494.xml - (B-V)o Vs /home/voindia/.aladir
File Edit Mode View Functions Interop Help
X : 2.84
Y : 4.5
X : Log Rev
(B-V)o
Y : Log Rev
X : 12
Y : 6.5
X : Log
Plx
95/sampl.239.hip_main1316431991494.xml - (B-V)o Vs /home/voindia/.aladin/.aladin.1595/sampl.239.l
Vmag [mag]
(B-V)o
Aladin v7.0
File Edit Image Catalog Overlay Tool View Interop Help
Location 03:41:22.63 +24:48:21.3
Clear
Frame ICRS
Allsky opt Allsky IR DSS Simbad NED PPMX 2MASS
POSSII.F-DSS2.482-PLATE
33
6.967° x 4.645°
Pleiades
I/239/hip
Drawing
POSSII.F
1/2x
6.464° x 6.451°
Search
V HIP RAhms DEdms Vmag RA(ICRS) DE(ICRS) Plx pmRA pmDE e
VizieR 16908 03 37 34.89 +21 20 35.7 9.35 54.39535518 21.34324066 25.23 141.55 -27.39
VizieR 18815 04 01 55.40 +25 55 25.3 9.03 60.48083231 25.92369675 6.53 7.18 -17.23
VizieR 18696 04 00 19.26 +23 32 03.5 10.45 60.08025882 23.53430249 3.80 -0.91 -7.81
VizieR 19050 04 04 53.36 +23 14 10.7 10.71 61.22233037 23.23631517 -0.61 -7.37 -2.98
VizieR 17609 03 46 19.89 +26 12 57.5 9.61 56.58286876 26.21598281 68.62 386.94 -198.16
VizieR 17592 03 46 06.74 +27 20 46.4 9.61 56.52808017 27.34623421 4.84 -0.59 -16.58
VizieR 17803 03 48 38.80 +21 03 25.4 10.56 57.16165867 21.05705805 14.91 105.89 -179.26
(c) 2010 UDS/CNRS - by CDS - Distributed under GNU GPL v3
16 sel / 223 src 23Mb
You are currently in Select mode.
You are currently in Zoom mode.
voindia@kaustubh-d...
Aladin v7.0
Server selector
[24 catalog(s) found ...
/home/voindia/.aladi...
/home/voindia/.aladi...

Research

A Population of Compact Elliptical Galaxies Detected with the Virtual Observatory

Chilingarian etal, Science **326,** 1379, 2011

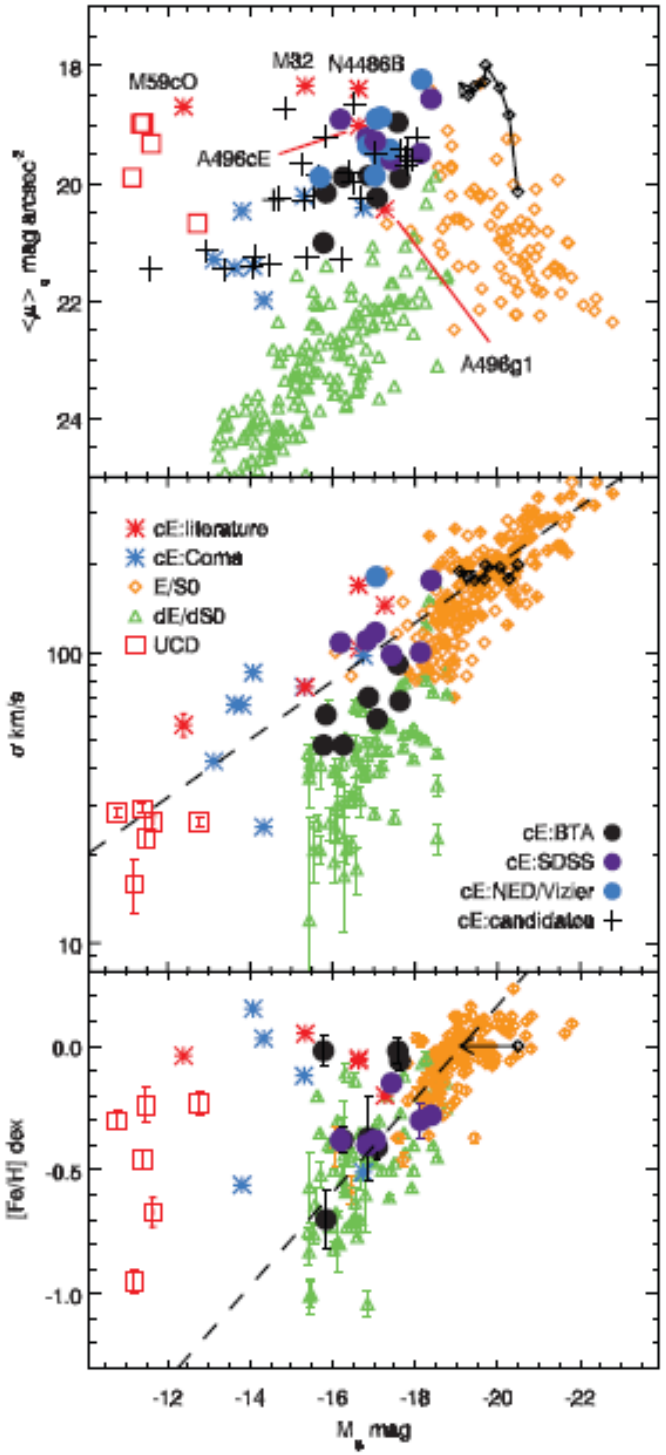
Create a workflow, i.e. an automatic data retrieval and analysis system to search for cE galaxies in large data collections.

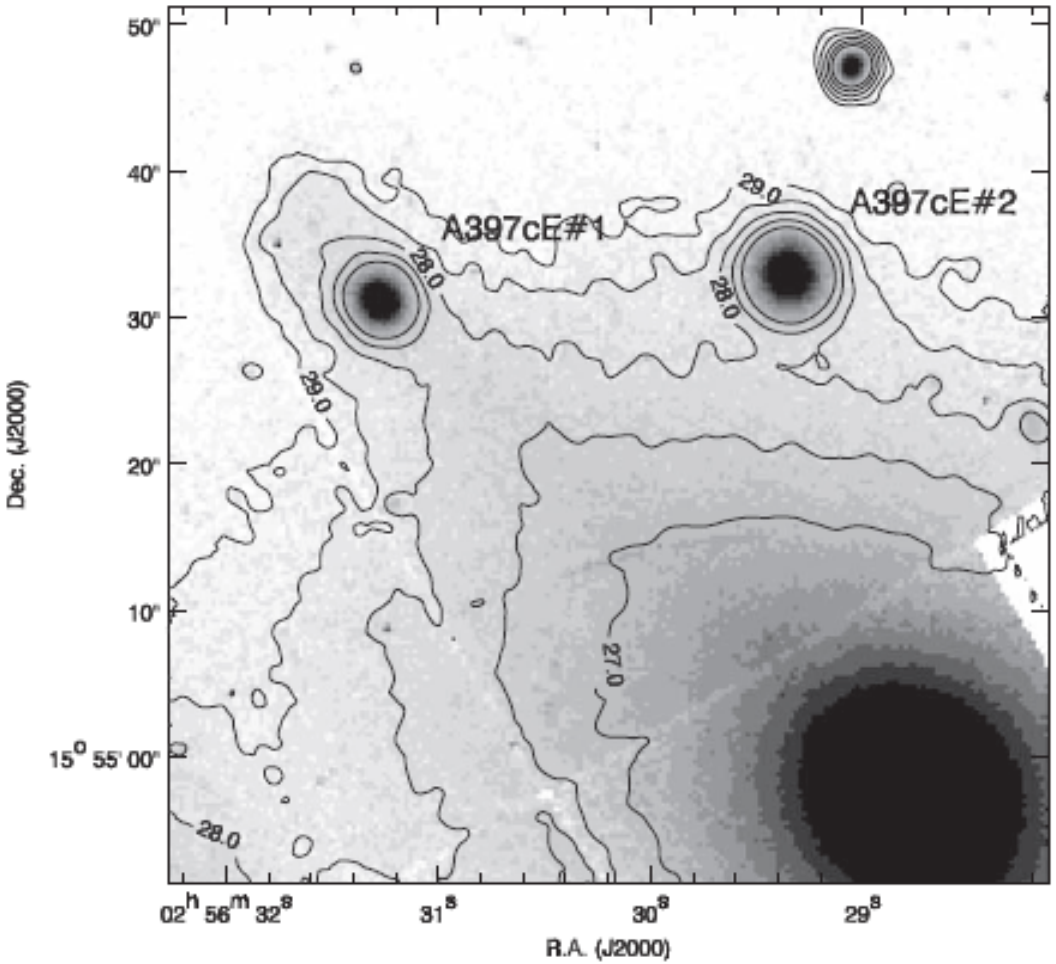
21 cE galaxies were found, using archival an new spectroscopic data.

All the cE exhibit old metal rich stellar populations different from dE galaxies.

These properties are reproduced by numerical simulations.

- Identify nearby galaxy clusters with z<0.055 using VizieR
- Gather precise measurements using VO services including NED
- Fetch HST images of selected galaxy clusters from Hubble Legacy Archive which uses the IVOA Simple Image Access Protocol
- For each image use SExtractor to obtain r_e, L nad approximate light profiles then identify cE candidates
- Use NED, VizieR and SDSS-Dr7 to obtain additional information.





Fragment of WFPC2 image of the central region of Abell 397

[6] Chilingarian et al. 2009

- Topcat, VOPlot, R for graphics
- PaperScope tracing citations and references
- DataScope for obtaining exhaustive data
- Splat-VO, Specview for spectral analysis

Thank You!

Reference

[1] E. Høg., 1995: Mælkevejens Historie. Astrometri med Hipparcos-Tycho-Roemer-Gaia, Forskningsministeriet, 1-3.

[2] S.G. Djorgovski, A.J. Drake, A.A. Mahabal, M.J. Graham, C. Donalek, R. Williams, E.C. Beshore, S.M. Larson, J. Prieto, M. Catelan, E. Christensen, R.H. McNaught., 2011: The Catalina Real-Time Transient Survey (CRTS), e-Print: arXiv:1102.5004 [astro-ph.IM], 6pp

[3] Christophe Arviset, Severin Gaudet and the IVOA Technical Coordination Group., 2010: IVOA Architecture Version 1.0, ivoa document coordinator, 77pp

[4] Science with the Virtual Observatory (Evanthia Hatziminaoglou) http://obswww.unige.ch/SFR/misc/VOScienceSwissVOday210110.pdf

[5] Andromeda Child http://www.andromedachild.com/2011/06/lost-world-of-barnards-star.html

[6] Igor Chilingarian, Véronique Cayatte, Yves Revaz, Serguei Dodonov, Daniel Durand, Florence Durret, Alberto Micol and Eric Slezak., 2009: A Population of Compact Elliptical Galaxies Detected with the Virtual Observatory, Science, 326, 1379-1382

Reference

CRTS (Catalina Real-Time Transient Survey)

http://crts.caltech.edu/pub.html

IUCAA (The Inter-University Centre for Astronomy and Astrophysics)

http://www.iucaa.ernet.in/

IVOA (International Virtual Observatory Alliance)

http://www.ivoa.net/

SDSS (Sloan Digital Sky Survey)

http://www.sdss.org/

SIMBAD

http://simbad.u-strasbg.fr/simbad/

VO (Virtual Observatory)

http://vo.iucaa.ernet.in/~voi/

2MASS (The Two Micron All Sky Survey at IPAC)

http://www.ipac.caltech.edu/2mass/