The amazing power of scripting DS9, and some totally rad things you can do with it.

Cooler than it sounds, really!

By

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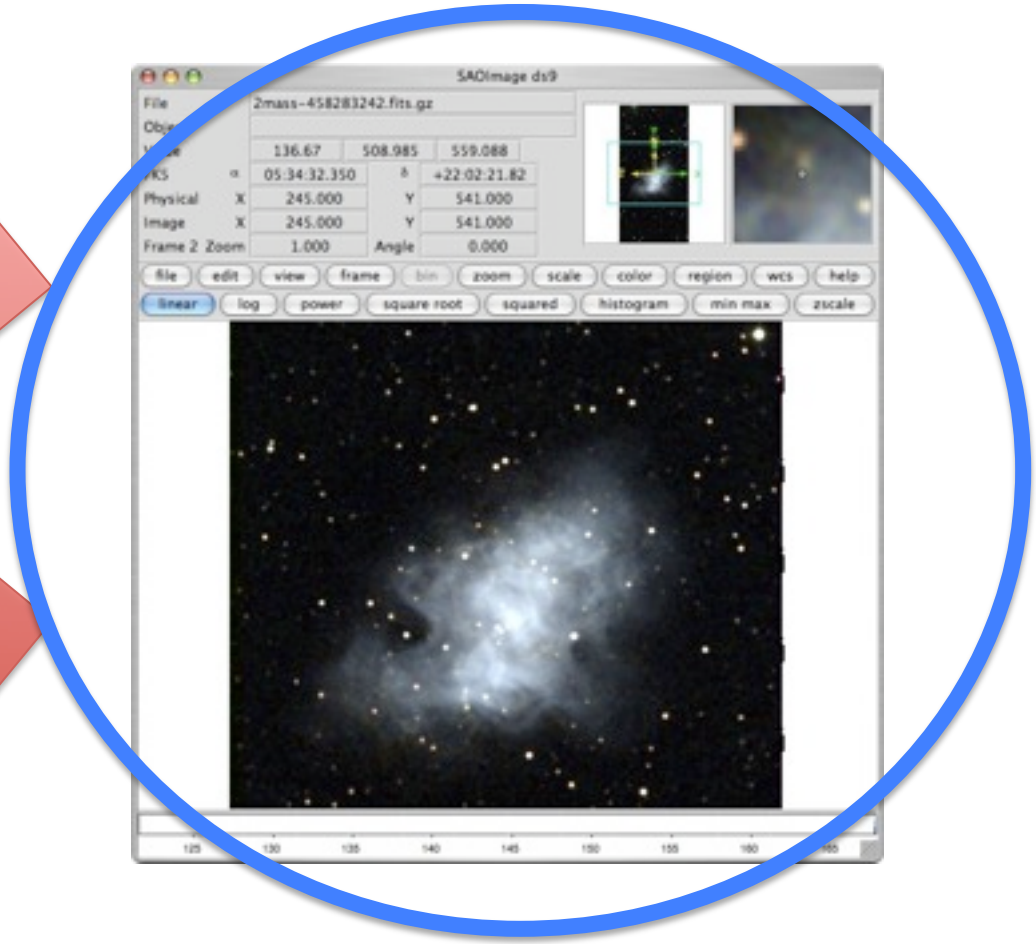
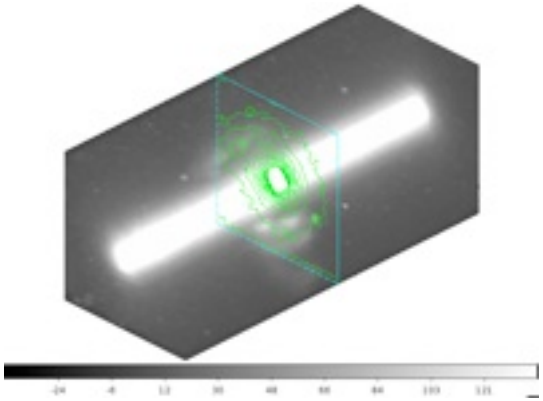
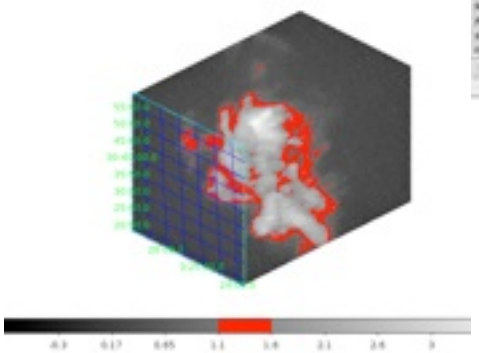
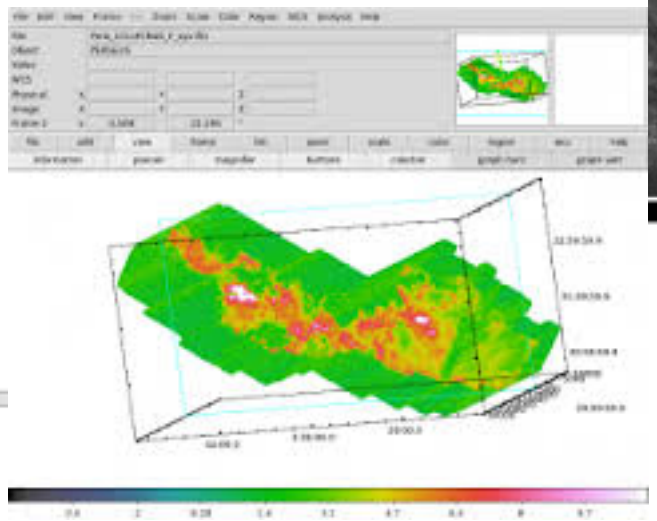
What is DS9?

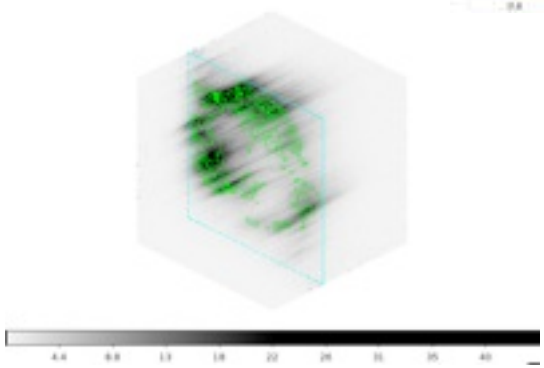
http://ds9.si.edu/site/Home.html

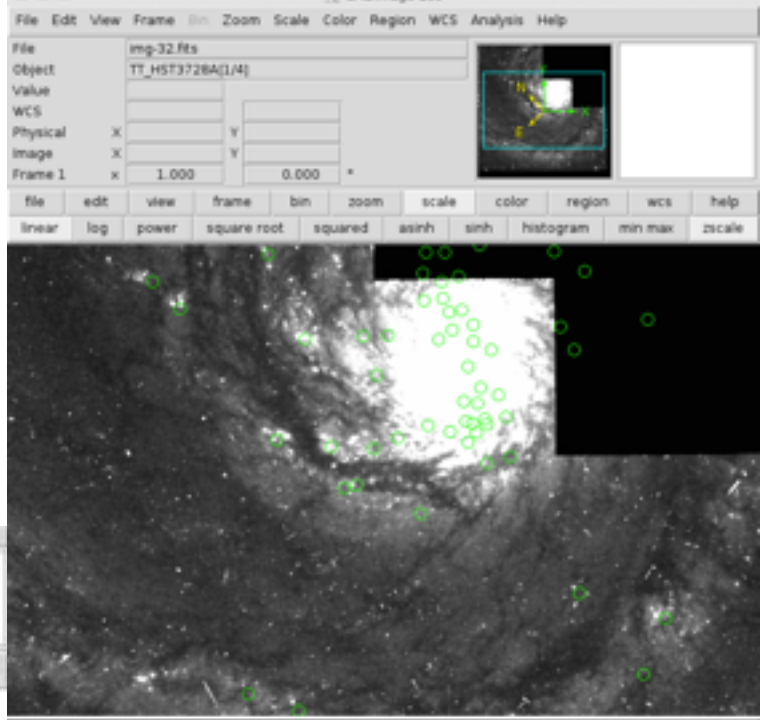








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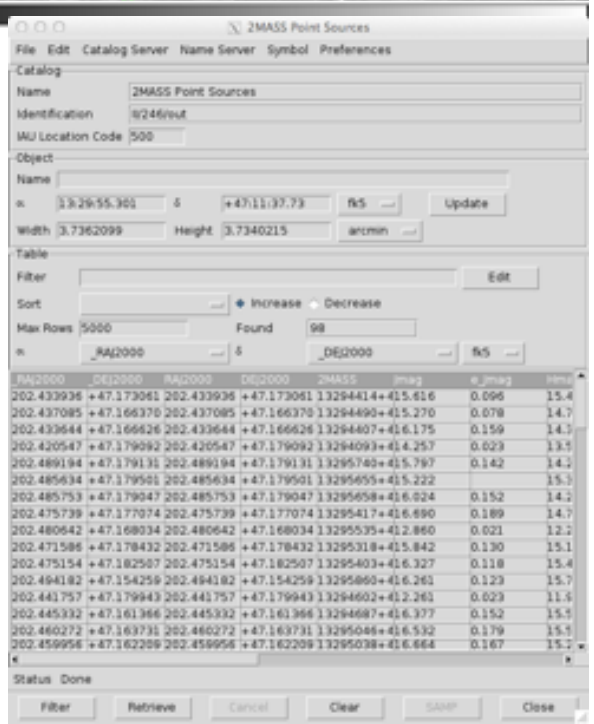
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Catalog
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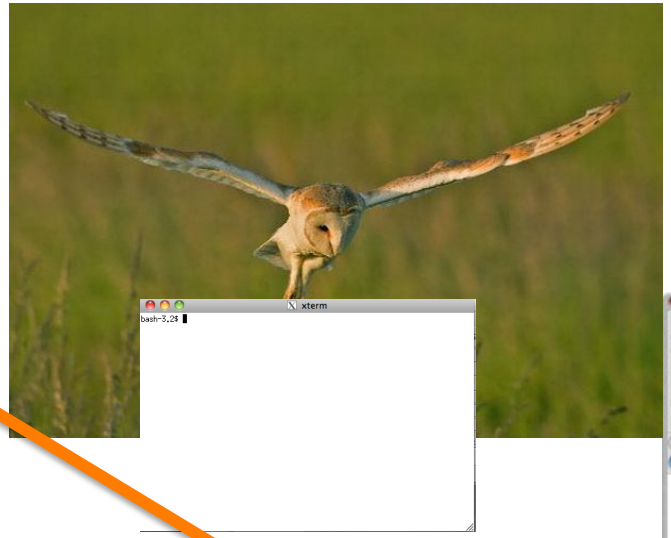
Table
Filter Edit
Sort Increase Decrease
Max Rows 5000 Found 98
α _RAJ2000 δ _DEJ2000 fk5
Status Done
Filter Retrieve Cancel Clear SAMP Close

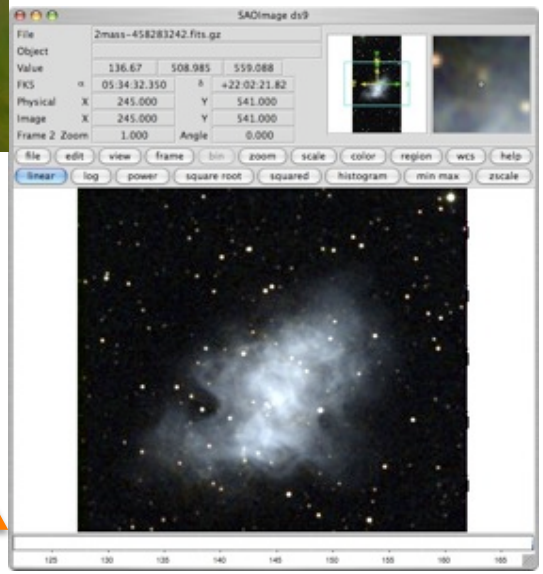
Python


```
#Program to test finding best guide stars in a finder chart
import ds9
from coordfuncs import *

object_name = 'Helix Nebula'
band = 'k'
size = 1
n_gstars = 10 #Number of brightest guide stars to find
gstar_mag_limit = 12.0
gstar_ra_limit = 10.0#arcmin
gstar_dec_limit = 10 #arcmin

obj = name_query(object_name) #Read in object
gstar_dec_limit = gstar_dec_limit/(2.0*60.0)
gstar_ra_limit = gstar_ra_limit/(2.0*60.0*obj.dec.cos())

ds9.open()
ds9.set('2mass survey '+band)
ds9.set('2mass coord '+str(obj.ra.deg())+' '+str(obj.dec.deg())+' degrees')
ds9.set('2mass close')
ds9.set('scale log') #Set to log scale
ds9.set('scale 2mass') #Set scale limits t o 2mass, looks okay
ds9.set('pan to '+obj.showcoords()+' wcs fk5') #Center frame on target object
ds9.set('catalog 2mass')
#ds9.set('catalog size '+str(gstar_ra_limit)+' '+str(gstar_dec_limit)+' arcmin') #Limit size of where guide stars are located
#ds9.set('catalog filter "$Kmag<=' + str(gstar_mag_limit)+'"') #Set magnitude threshold for looking for guide stars
ds9.set('catalog filter "$RA2000>='+str(obj.ra.deg()-gstar_ra_limit)+'&&$RA2000<='+str(obj.ra.deg()+gstar_ra_limit) \
  + '&&$DE2000>='+str(obj.dec.deg()-gstar_dec_limit) + '&&$DE2000<=' + str(obj.dec.deg()+gstar_dec_limit) \
  + '&&$Kmag<=' + str(gstar_mag_limit) + '"')
ds9.set('catalog sort "Kmag" incr') #Sort list by starting from brightest K-band mag. and getting dimmer as you go down
ds9.set('catalog export tsv tmp.dat') #Save catalog list as a tab seperated value file for later trimming
lines = open('tmp.dat').readlines() #Open catalog list tsv file into memory
if len(lines) > 1:
  open('tmp.dat', 'w').writelines(lines[0:n_gstars+1]) #Truncate and save catalog list
  ds9.set('catalog clear') #Clear 2MASS catalog
  ds9.set('catalog close') #Close 2MASS catalog window
  ds9.set('catalog import tsv tmp.dat') #Load only brightest stars to be potential guide stars
  ds9.set('mode catalog') #Set mode to catalog so user can click on possible guide stars and look at their stats
else:
  ds9.set('catalog clear') #Clear 2MASS catalog
  ds9.set('catalog close') #Close 2MASS catalog window
  print 'ERROR: No possible guide stars found. Check mangitude, RA, & Dec limits and retry.'
```

XPA



DS9



XPA

- http://hea-www.harvard.edu/RD/xpa/

- Allows you to control DS9 via the terminal
- Open DS9 from command line
  - *ds9 &*
- Send command to DS9:
  - *xpaset -p ds9 blahblahblah*
- Grab information from DS9:
  - *xpaget ds9 blahblahblah*

- More info on XPA commands: http://ds9.si.edu/ref/xpa.html

Python Library Wrapper for XPA & DS9

```python
#Python library for accessing DS9 and XPA.
#Written by Kyle Kaplan March 2014.
from subprocess import call #Allow python to access command line
from subprocess import check_output #Allow python to access command line and return result to a variable
import time #To put in delays


#Open DS9
def open():
  call('ds9 &', shell=True)
  time.sleep(2) #Give computer a few seconds to respond after opening DS9

def close():
  call('xpaset -p ds9 exit')

#Get xpaget statements from ds9
def get(command):
  result = check_output('xpaget ds9 ' + command, shell=True) #Get information from ds9 using XPA get
  return str(result).strip() #return information grabbed from ds9

#Send xpaset commands to ds9
def set(command):
  call('xpaset -p ds9 ' + command, shell=True)
  #time.sleep(0.5) #Set delay after each command to give computer time to respond before the next command

#Allow user to set delays in DS9 scripts
def wait(delay):
  time.sleep(delay)

#Special command for drawing regions onto ds9
def draw(command):
  print 'echo "' + command + '" | xpaset ds9 regions'
  call('echo "' + command + '" | xpaset ds9 regions', shell=True)

def rot(angle):
  set('rotate '+str(angle))

def rotto(angle):
  set('rotate to '+str(angle))

def north():
  set('rotate to 0')
```

Demo Time!

- Demos
  - Rotate
  - Zoom
  - Compare catalogs
  - Grabbing and displaying crosshair coordinates
  - Make a DSS finder chart

- Real world scripts I have made
  - Find brightest stars in field
  - IGRINS finder charts