

ACT ONE

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

Cooler than it sounds, really!

6 EXT. SPACE STATION DEEP SPACE NINE (OPTICAL)
Establishing the station.

7 INT. JAKE & NOG'S QUARTERS

Nog is sitting in a chair with his arms crossed,
glaring at Jake and determined not to be swayed. Jake
is just as determined to get the diminutive Ferengi
Cadet to bend.

NOG

No.

JAKE

Come on, Nog...

NOG

No.

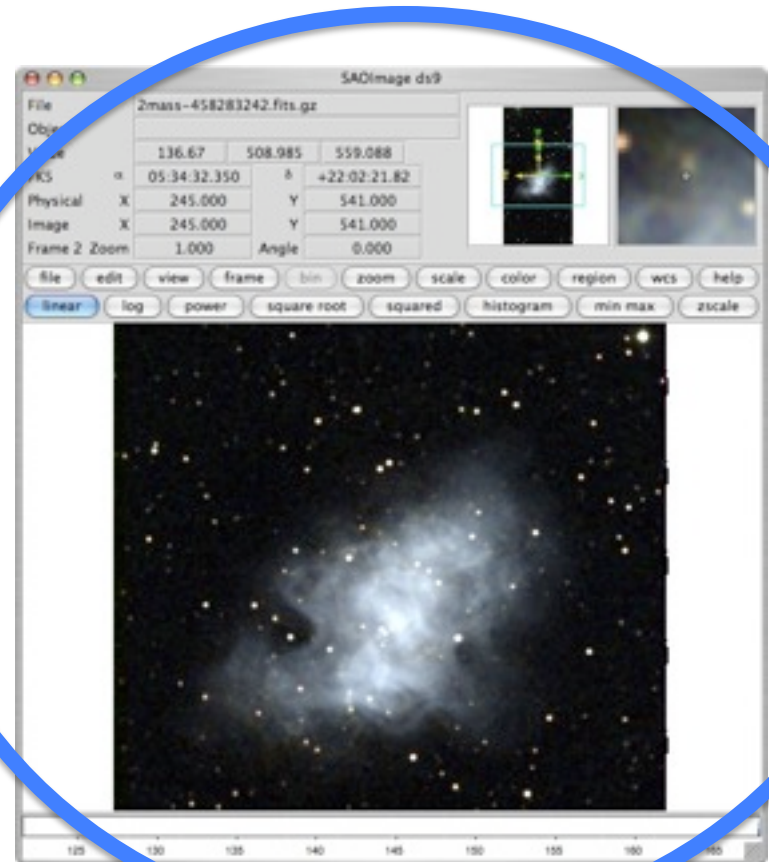
Why not?

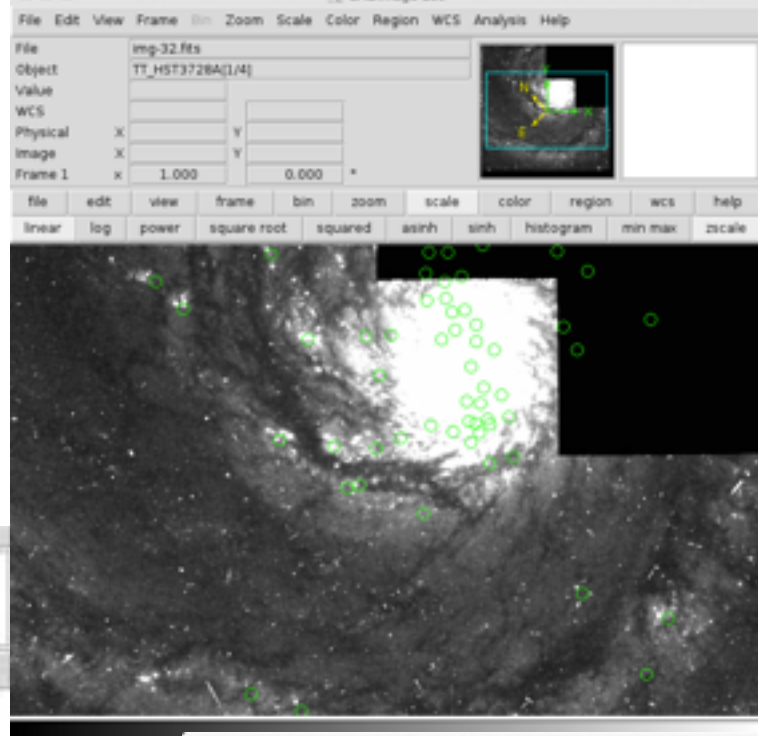
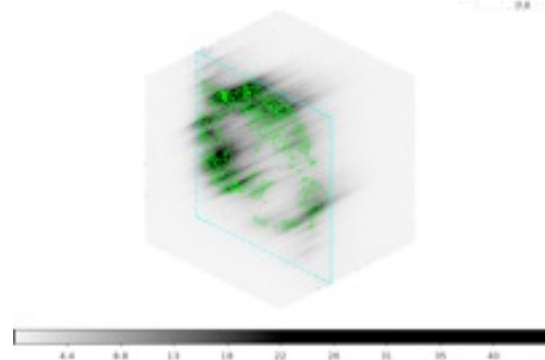
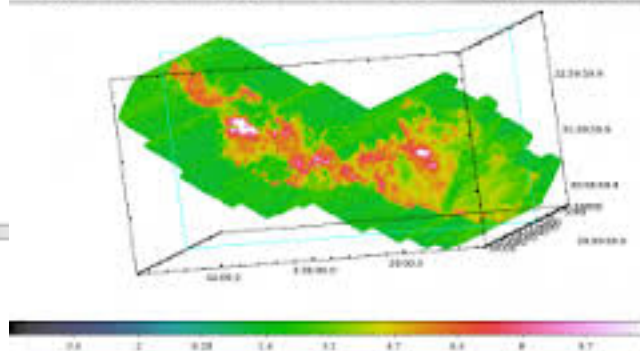
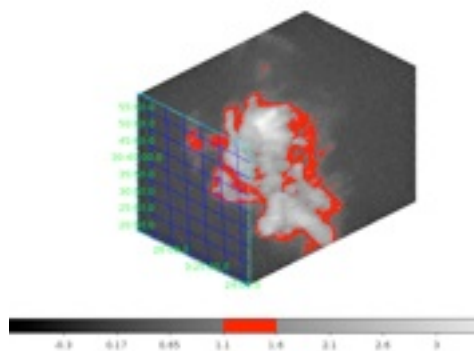
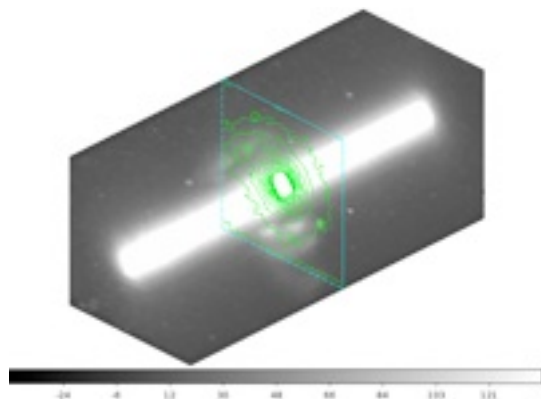
By

Kyle Kaplan

What is DS9?

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





2MASS Point Sources

File Edit Catalog Server Name Server Symbol Preferences

Catalog

Name 2MASS Point Sources

Identification 82460ut

WU Location Code 500

Object

Name

ra 3.2655360 s +47.1137.73 fls Update

width 3.7362099 Height 3.7340215 arcmin

Table

Sort Increase Decrease

Max Rows 5000 Found 98

n RA2000 DE2000 fls

RA2000	DE2000	RA2000	DE2000	2MASS	jmag	hmag	name
202.433936	+47.173061	202.433936	+47.173061	13294414	+415.616	0.096	15.4
202.437085	+47.166370	202.437085	+47.166370	13294490	+415.270	0.078	14.7
202.433644	+47.166626	202.433644	+47.166626	13294407	+416.175	0.159	14.3
202.420547	+47.179092	202.420547	+47.179092	13294093	+414.257	0.023	13.5
202.489194	+47.179131	202.489194	+47.179131	13295740	+415.797	0.142	14.2
202.485634	+47.179501	202.485634	+47.179501	13295655	+415.222		15.3
202.485753	+47.179047	202.485753	+47.179047	13295658	+416.024	0.152	14.2
202.475739	+47.177074	202.475739	+47.177074	13295417	+416.690	0.189	14.7
202.480642	+47.168034	202.480642	+47.168034	13295535	+412.860	0.021	12.2
202.471586	+47.178432	202.471586	+47.178432	13295318	+415.842	0.130	15.1
202.475154	+47.182507	202.475154	+47.182507	13295403	+416.327	0.118	15.4
202.464182	+47.154259	202.464182	+47.154259	13295860	+416.261	0.123	15.7
202.441757	+47.179943	202.441757	+47.179943	13294602	+412.261	0.023	11.6
202.445332	+47.161366	202.445332	+47.161366	13294687	+416.377	0.152	15.5
202.460272	+47.163731	202.460272	+47.163731	13295046	+416.532	0.179	15.1
202.459956	+47.162209	202.459956	+47.162209	13295038	+416.664	0.167	15.7

Status Done

Filter Retrieve Cancel Clear Save Close

GRAHAM
CHAPMAN

JOHN
CLEESE

TERRY
GILLIAM

ERIC
IDLE

TERRY
JONES

MICHAEL
PALIN

MONKEY PYTHON

```
#!/usr/bin/perl
#Program to test finding best guide stars in a finder chart
import sys
from coordinates import *

object_name = "M11a Nebula"
band = "R"
filter = "J"
#RADEC = 18 observer of brightest guide stars to find
star_mag_limit = 22.8
star_ra_limit = 18.000000
star_dec_limit = 18.000000

obj = name_to_object(object_name) #Must be object
star_dec_limit = star_dec_limit/DEG
star_ra_limit = star_ra_limit/DEG
star_mag_dec_deg = star_mag_dec_deg/DEG

def search():
    obj.calc('J2000 survey', 'obsrv')
    star_calc('J2000 catalog', 'star(Cat.ra_deg())', 'star(obj.dec_deg())', 'magmax')
    star_calc('J2000 close')
    star_calc('make list') #Get to log scale
    star_calc('make stars') #Get from limits to 2 stars, looks okay
    star_calc('set to mag5_starcount(Cat)', 'set RA') #Enter frame from on target object
    star_calc('catalog size', 'star(Cat.ra_limit)', 'star(star.ra_limit)', 'arcmin') #RA limit size of where guide stars are located
    star_calc('catalog filter', 'bandmag = star(star.mag_limit/1000)' #Star magnitude threshold for looking for guide stars
    + 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_deg())', 'RA20000000 = star(Cat.ra_deg())', 'star(ra_limit)'
    + 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_deg())', 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_limit)'
    + 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_deg())', 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_limit)'
    + 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_deg())', 'RA20000000 = star(Cat.ra_deg())', 'star(Cat.ra_limit)'
    star_calc('catalog sort by mag dec') #Place catalog list as a tab separated value file for later trimming
    lines = open('mag dec', 'w') #Write lines to file into memory
    if len(lines) > 1:
        star_calc('write lines', 'lines', 'lines') #Flatten and save catalog list
    star_calc('catalog close') #Close catalog
    star_calc('catalog close') #Close 2000 catalog
    star_calc('catalog sort by mag dec') #Place catalog list as a tab separated value file for later trimming
    lines = open('mag dec', 'w') #Write lines to file into memory
    star_calc('catalog close') #Close catalog
    star_calc('catalog close') #Close 2000 catalog
    print "ERROR: No possible guide stars found. Check magnitude, RA, & Dec limits and retry."
```

"Marvelously
zany humor."
-NEWSWEEK

SAOImage ds9

File Object Value FKS Physical Image Frame 2 Zoom File edit view frame bin zoom scale color region wcs help

2mass-458283242.fits.gz

	136.67	508.985	559.088
FKS	α 05:34:32.350	δ +22:02:21.82	
Physical	X 245.000	Y 541.000	
Image	X 245.000	Y 541.000	
Frame 2 Zoom	1.000	Angle 0.000	

Linear log power square root squared histogram min max zscale

125 130 135 140 145 150 155 160 165

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](http://ds9.si.edu/ref/xpa.html)

Python Library Wrapper for XPA & DS9

```
#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('xpa set -p ds9 exit')

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

#Send xpa set commands to ds9
def set(command):
    call('xpa set -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 + '" | xpa set ds9 regions'
    call('echo "' + command + '" | xpa set 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