## Using ds9:

SAOImage DS9 is an astronomical imaging and data visualization application. DS9 supports FITS (*Flexible Image Transport System*) images and binary tables, multiple frame buffers, region manipulation, and many scale algorithms and colormaps.

SAOImage DS9 Reference Manual can be found at:

http://hea-www.harvard.edu/RD/ds9/ref/index.html

Load your radio data in ds9
***either***

at the prompt type

prompt:~$ ds9 radio_image_filename.fits

***or***

at prompt type

prompt:~$ ds9 &

**The Graphical User Interface (GUI):**

Go to File → Open → choose your radio_image_filename.fits

Examining your data

File → Header

This provides information about the FITS header. This is very useful specially when you are using archived processed data/image. It allows the user to figure out when the data was observed, processed etc ….

Familiarize with the various tools such as scale, color, zoom etc …

**Simple Analysis:**

Load the X-ray image *Xray_image.fits*

Align wcs puts north up.

Analysis → Smooth → vary kernel radius (1, 5, 10, 20)

- Save smoothed image with kernel radius 10

Analysis → Contour parameters

- Use different parameters for the contour parameters

Analysis → Coordinate Grid Parameters

- Use different parameters for the grid parameters

Analysis → Image servers

Analysis → Ctalog → Radio NVSS

**Making a RGB image:**

Based on Chandra online thread:

http://hea-www.harvard.edu/RD/ds9/user/rgb/index.html

To use the three-color capabilities of ds9, the data must be loaded into a special RGB frame. This frame will contain all three files, stacked together in separate layers.

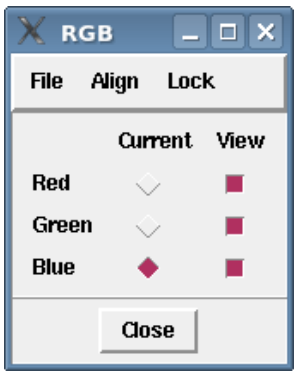
Either command line:

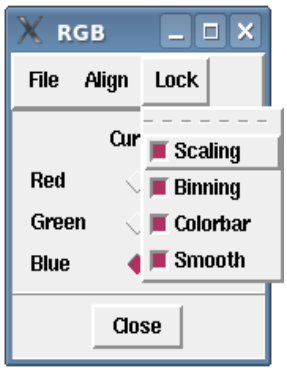
```
ds9 -rgb -red img_soft7.fits -green img_med7.fits -blue img_high7.fits &
```

OR GUI:

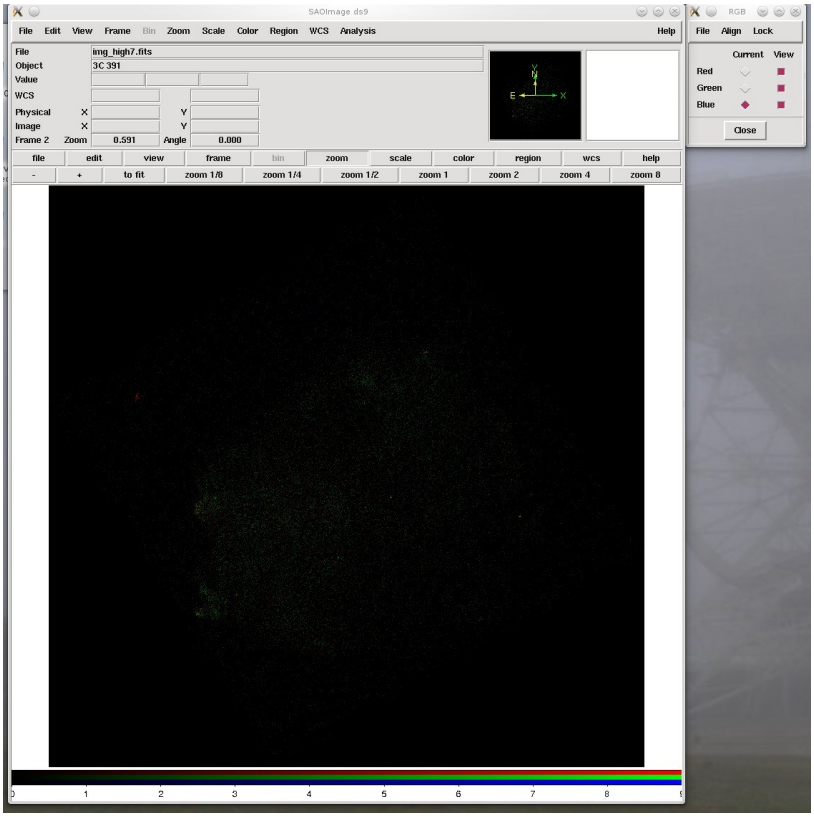
1. Launch ds9
2. Choose "New Frame RGB" from the "Frame" menu.

   When the new frame is created, the RGB window (Figure 1) should open as well. If it doesn't, open it from the "Frame → RGB..." menu.
3. Make sure the "Red" band is selected in the "Current" column of the RGB window, then choose "File → Open..." in the main ds9 window and select the red file.
4. Change the current band to "Green" in the RGB window and open the green file.
5. Change the current band to "Blue" in the RGB window and open the blue file.

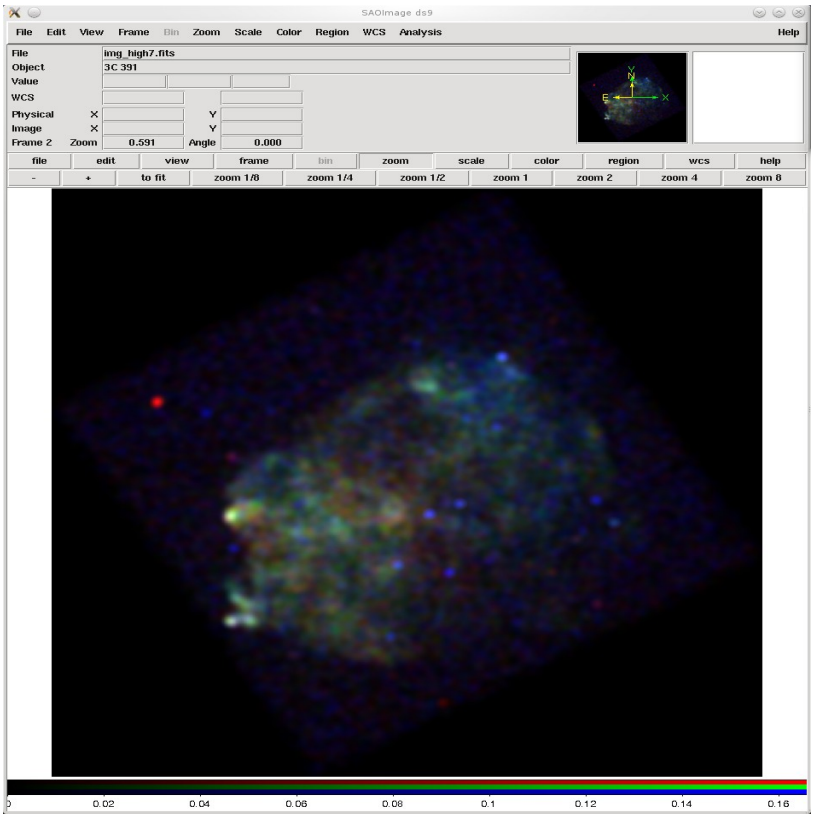



- Each frame of the RGB image may have different binning, scaling, smoothing, and colorbars applied to it.
- You can "lock" the frames together, so that the setting is applied to all three frames at once.

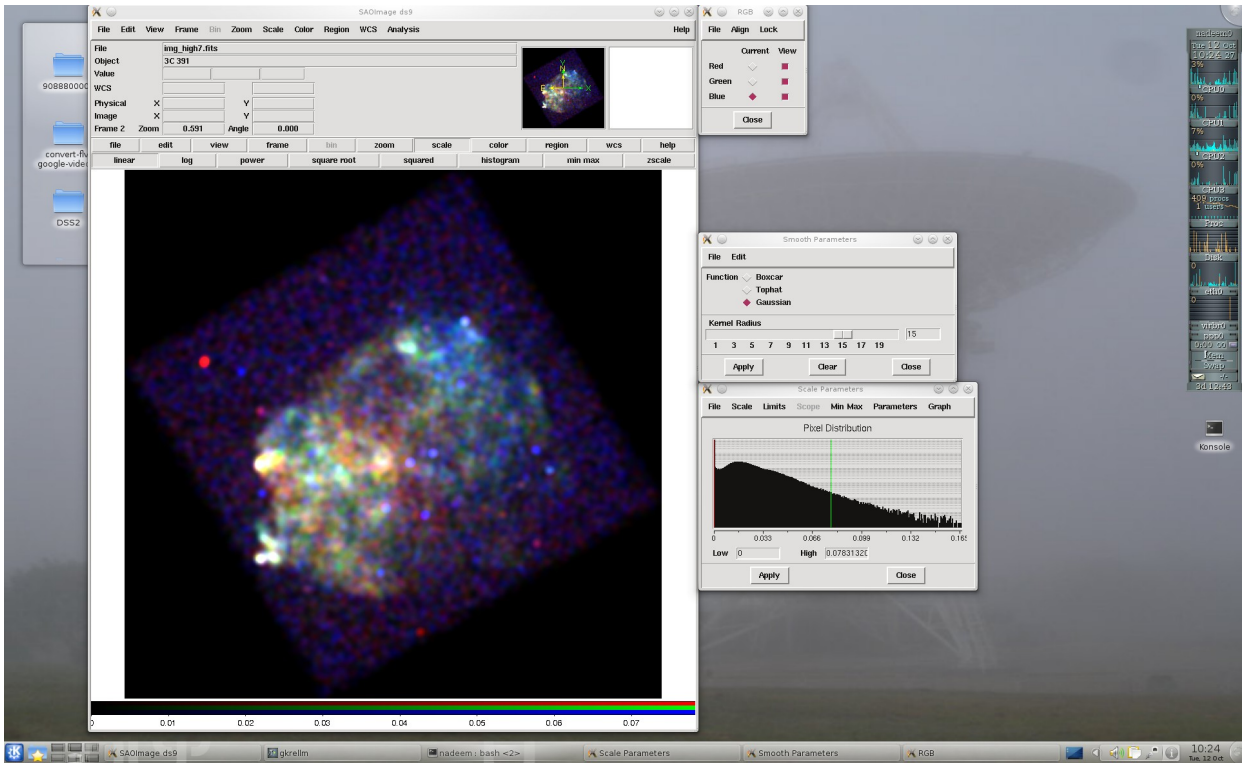



## Smoothed with Gaussian of radius 15



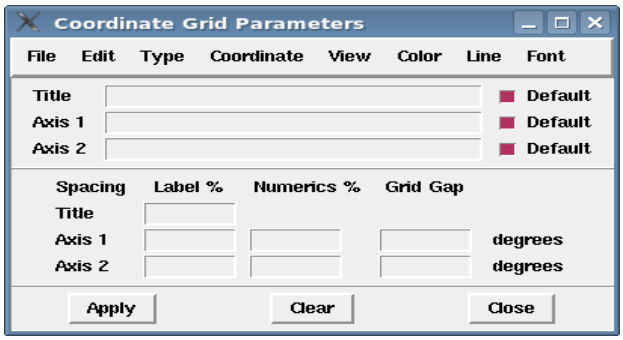
# Adjusting the Scale Parameters

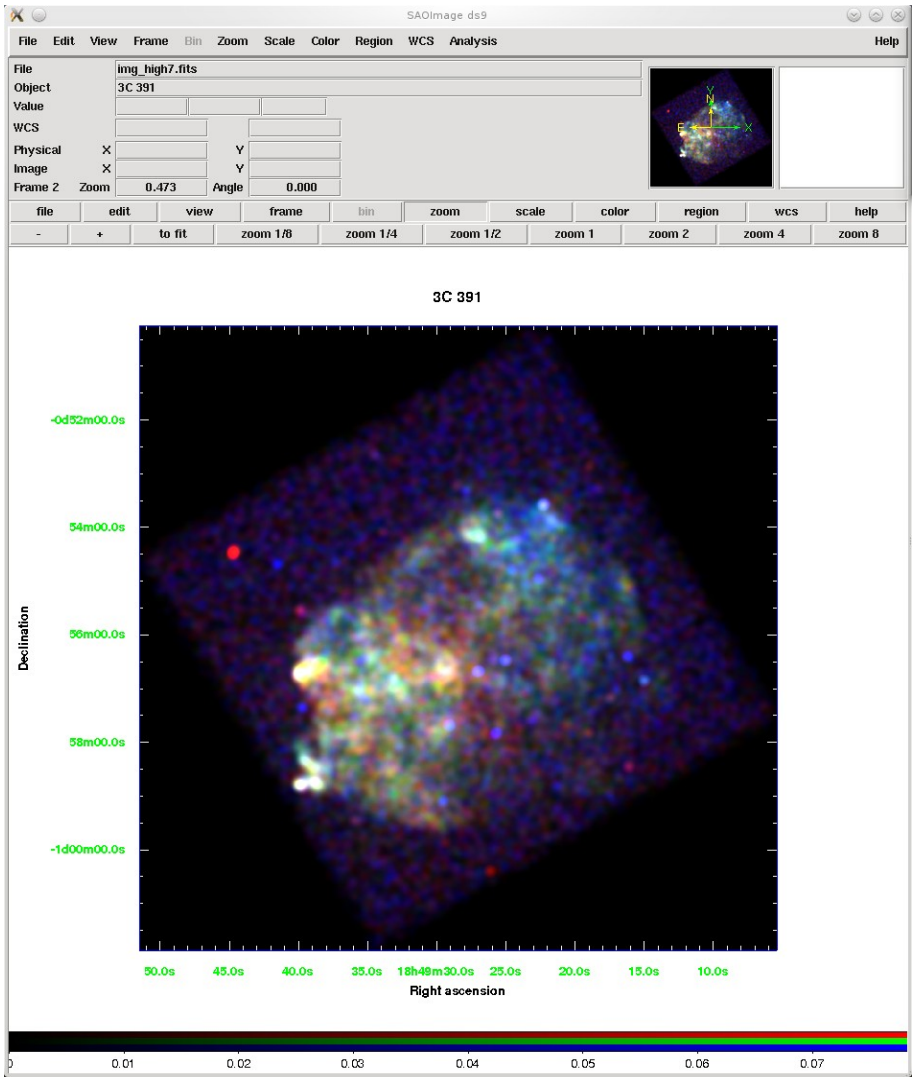
- This data is being displayed with a "log: minmax" scale.
  - That means that ds9 stretches the scale to encompass the range of pixel values in the file.
  - Adjusting the minimum and maximum scale values sets a threshold for the background data and brings out features.
- To change the minimum and maximum values, open the "Scale → Scale Parameters" dialog box.
  - The pixel distribution shown is for the band selected as "Current" in the RGB window; when the a different band is selected, the histogram of pixel values is updated to match.
- To adjust the values, use the cursor to grab the red (minimum) or green (maximum) vertical lines on the plot and drag them to the desired location.
  - You can type a value in to the "Low" or "High" field and hit "Apply" to set the limits.
- A basic guideline for setting the low value is to minimize the contribution of the background.
  - That is, adjust the minimum of each band until the background of the image is flat (i.e. solid black).
  - For the maximum value, bringing it in to the last data point in the pixel distribution is usually sufficient.



# Adding a Coordinate Grid

- To add a coordinate grid to the image, choose the "Coordinate Grid" option from the "Analysis" menu.
- Then choose "Coordinate Grid Parameters" from the same menu to open the preferences dialog .



# Saving the Output

Once you are happy with your true color image, there are a number of output options in ds9.

- **Image formats:** from the "File → Save Image As..." menu, you can choose JPG, PNG, or TIFF file formats.
- **Postscript:** to create a postscript file, go to "File → Print..." and select "Print To: File".

Currently it is **NOT** possible to save the state of the ds9 imager, meaning that you cannot save the composite RGB frame and reopen later for further analysis.