ISYA 2012

Exercise 3 - Aladin : making RGB images

Summary

Finding and loading data in Aladin, adjusting the image properties and combining the image into a false colour image. In this exercise we will explore the Aladin interface in some more detail. We will locate 3 images in the Virtual Observatory taken in different colours and download them. After experimenting with changing the contrast and brightness of the images we will combine them to make a false colour RGB image. Along the way we will you will become more familiar with the Aladin interface.

The image we will create will be in false colour as while there are lots of Blue, Red and Infra Red images in the VO there are few green or visual images for the green component. There are a number of strategies that can be adopted to replace the green component – one is to create a false colour image that we have used here. A second is to reuse either the blue or red component as the green component. This tends to bias the image colour towards this component. A third strategy is to use the default mode in Aladin for RGB generation from only two images. This averages the blue and red images to produce a synthetic green channel.

(**Tip**: You need to be aware that the windows that open allowing you to select items or change their properties behave as 'popups' rather than as more traditional windows. As a result they can easily be hidden by the active window if it is larger or in the same position. If you 'lose' a popup or it does not appear check the windows toolbar – it may be hidden. Clicking on the appropriate button on the toolbar should bring it to the top.)

The activity

1. Click on the **Aladin** icon on the desktop of the PC/laptop. In this exercise we will be loading the images via the file menu so we have more control over which images are loaded than just allowing **Aladin** to select one.

2. To load the images we need to open the '**Server Selector**' popup. This can be done via **File – Load Astronomical Image – DSS.** This constrains the choices you are offered to just **DSS** images and helps you stop getting overwhelmed at this stage.

3. Select the DSS server nearest to you. A window should popup titled '**Server Selector**'. If it just starts loading an image **Aladin** has still remembered the last object you explored. Deleting all the data as in step one should solve this.

4. The Sky Survey should default to a value – check it is the **DSS2 Red** plate if not select it from the drop down list.

5. In the **Target Box** enter the object you want to get the image of in this case enter '**M1**' and press the **submit** button. You should see the image being downloaded into **Aladin** if the window is visible – if not use the button on the windows toolbar to bring the **Aladin** Window to the top.

6. We now need to load two more images in different colours. If the server selector window is not visible first click on the '**server selector**' button on the windows toolbar. The details should still be filled in from the previous image. Click on the arrow on the image survey drop down box and select the **DSS2 Blue** image and then press the **submit** button. Repeat this for the **DSS2 Infrared** image.

7. You should now have 3 images in the stack. To see all three images at once click the '**multiview**' button with 4 squares just under the bottom left of the image window. You will then need to click on the tick boxes for two of the images to turn these on and show them in three of the windows.

8. While you have all four images open compare the **Infrared** image with the **Blue** and **Red** images. One thing that is obvious is that there is a **U Shaped** area on the left of the **Infrared** image where there is no **Infrared** emission but there appears to be emission in the other wavebands. A plausible explanation is that there is hot gas here but no warm dust that would emit in the **infrared**. (**Remember this is a negative image so dark areas are where there is most emission**). Also note that the streak in the left of the image.

9. To make certain areas of the image more visible we can alter the contrast using the '**Pixel**' function on the vertical toolbar. Select the **Infrared** image by clicking on the title of the **IR** image in the stack. The image should be highlighted with a thin blue border. While you are there move the cursor over the other images – note how they have green borders while the cursor is over them and the appropriate image in the stack is highlighted in grey.

10. We now need to show the **IR** image full screen, this is done simply by clicking on the multiscreen view button with a single box. You might need to alter the zoom factor and drag the box so the whole of the nebula is shown.

11. To change the contrast and brightness of the **IR** image click on the '**Pixel**' button on the vertical toolbar. This will open the pixel mapping window. This shows a histogram of the number of pixels of each value and a band along the top showing the colours – in this case the grey scale they are mapped to. Try clicking the **Pow2**, **Sqrt** & **Log** boxes and watch the effect on the image. You can also try dragging the small triangles below the histogram to see the effect on the image. Note how the trail

of the object on the left hand side shows up more when you increase the contrast with the **Log** or **Sqrt** functions. Also the background noise increases.

12. You can easily get back to the default linear and greyscale by pressing the '**Reset**' button. **Try it now**. Having reset the image move the cursor over the greyscale bar above the image. Note how this highlights different areas of the image that are the same brightness or value as where the cursor is on the image.

13. You can also experiment with selecting different colour maps - remember this is not the same as a **RGB** image. What this is doing is mapping pixels of certain brightness ranges to different colours. When you have done press the reset button to restore the image to it's default settings. (**Also have a look at the help popup by pressing the help button**.)

14. Lets have a look at when and where the plate was taken. Click on the **Prop**(erties) button on the toolbar – careful not to click on delete – if you do you will have to reload the image. Some details are shown on the **Properties** popup but more detail can be obtained by looking at the **FITS Heade**r by using the button '**get original header**'. There is a lot of information there – for instance the Observation time is shown and the epoch in decimal years. Also note that the observatory, telescope and location are shown. A full discussion of all the parameters is beyond this exercise. When you have looked at the information close the popup.

15. For the next part of this exercise we will create an **RGB** image. You should still have an **Infrared**, **Red** & **Blue** image on the stack. If any are missing you need to reload them. First press the **RGB** button on the toolbar. The **RGB Generator** window should popup. This window is fairly simple – it has 3 drop down boxes that allow you to select which images are used for the **Red**, **Green** & **Blue** Channels. As we have no green channel select them as follows **Red Channel = Infrared image**, **Green Channel = Red image** and **Blue Channel = Blue image**.

16. The colours of the resulting image can then be adjusted using the pixel button. In this case the pixel mapping box has a histogram for each component.

17. When you are happy with the image it can be saved via the menu option file – save the current view – jpeg or select the format you require.

18. There is also an option under **File** – **Backup** the stack this allows you to save the current stack – however this does not save any **RGB** images you may have created. This may be due to the fact there is no **FITS** standard for **RGB** files.

19. To complete the exercise let's see if we can identify the source in the area of the bubble that had no infrared emission. We need to load a catalogue to see what the object is. First try the **Simbad** catalogue use **File** – **load Catalog** – **Simbad**

Database. This should load a copy of the objects from the **Simbad** Database at the top of the stack. You should find the **Crab Nebular Pulsar** identified, a **gamma** ray source, an **X ray** source and a few stars but no identification of the object in the **IR bubble**.

20. Try the **NED** database next (**File – load Catalog – NED Database**)– It does not appear to be in there either – if you are not sure if there is an object identified in the area highlight the bubble by clicking and dragging a box across the bubble – any objects will be shown in the bottom list box. You can also turn off the **RGB** image and turn on the **IR** image by clicking the **IR** image box. Incidentally if you can't see all the image name if you hover the cursor over the name in the stack you will get a tool tip with the full name. In the full version we will install later you can also make the stack wider by dragging the edge. If all else fails you can also use the properties window or select it in multiview.

21. If you select the **2MASS** catalogue (**File – load Catalog – Surveys** in **Vizier – MASS**). You should be able to identify the star near the centre of the **IR** bubble as '**083.659236**'. It has magnitudes in the **H**, **J** & **K** bands but there is little more information if you click on the link which will show you the full entry in the catalogue.

This exercise has introduced you to some more features of the Aladin Interface. To consolidate your knowledge You can repeat this exercise on your own favourite objects. You could try **M13** (**globular cluster**), **M45** (**Pleiades**), **M42** (**Orion Nebula** and look for the stars only visible in the infrared in **2MASS** and other infrared surveys), **M17**, **M22** or **M27**. In some cases the objects are so large you will have to increase the default radius. You can also try making a full colour image from only the **Red** and **Blue** images and allow **Aladin** to default to the average for the green channel (this only works if you have 2 images on the stack).

Save the images both RGB and monochrome to your computer.