Introducing the General Public to FITS Images

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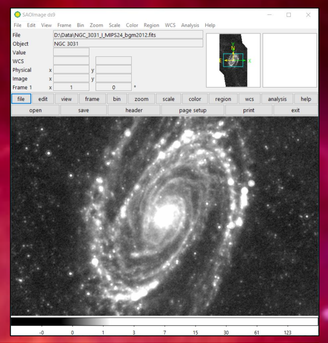
Although fully-processed astronomical images in FITS format as well as the tools to work with these files are publicly available, neither most educators nor the general public are aware of the existence of these data or how to access them.

Through work with secondary school and university students, I have developed a series of activities that teach people how they can download astronomical FITS files and perform quantitative analyses with these data.

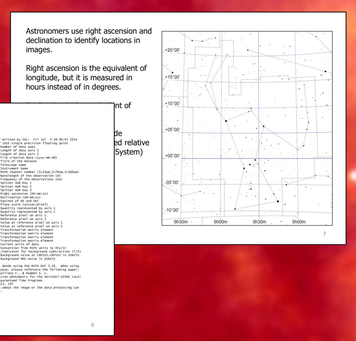
http://www.jb.man.ac.uk/~gbendo/Sci/Teach/teachmaterial.html

Visit the website above (scan the QC code for the website) to download the educational material on this poster.

Introduction to Astronomy Images and the DS9 Image Viewer



This guide was developed to provide a straightforward introduction to working with FITS images and the DS9 image viewer. It can be used by secondary school students, university students, or the general public.

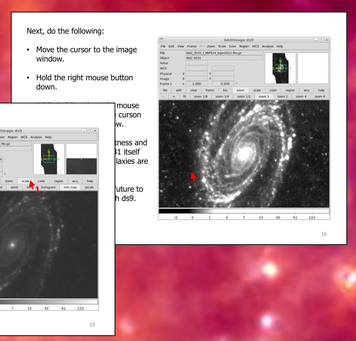


FITS files contain headers that may contain various information about the files.

FITS image viewers can be used to look at this information.

This information could include the following:
- Image creation information
- Coordinate information
- Data units
- Data processing history

The introduction provides an overview of the FITS format and discusses basic concepts regarding astronomy images.



Next, do the following:
- Move the cursor to the image window.
- Hold the right mouse button down.

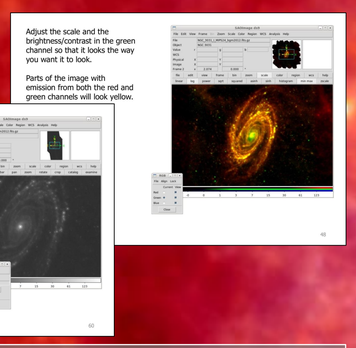
Next, click on Scale.

After this, click on log.

The emission from the entire galaxy is now visible.

(With some images, clicking on Scale in the menu bar and then selecting 99.5%, Zscale, or Zmax sometimes produces better results.)

The quick start guide provides simple instructions on how to display images in DS9.



If you double-click on the circle, an information box with appear with the coordinates and size of the circle.

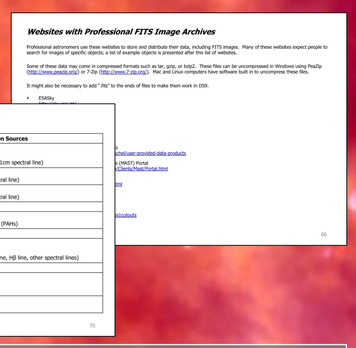
You can also open this window by selecting the region in the image and then selecting "Get Information" from the region menu.

You can put the circle in a specific position or set it to a certain size if needed.

Adjust the scale and the brightness/contrast in the green channel so that it looks the way you want it to look.

Parts of the image with emission from both the red and green channels will look yellow.

The more detailed information on DS9 covers various menu options and discusses how to perform photometry and create multiband colour images.



Websites with Professional FITS Image Archives

Professional astronomers use these websites to store and distribute their data, including FITS images. Many of these websites expect people to search for images of specific objects; a list of example objects is presented after this list of websites.

Some of these data may come in compressed formats such as tar, gzip, or bzip2. These files can be uncompressed in Windows using PeaZip (http://www.peazip.org/ or 7-Zip (http://www.7-zip.org/). Mac and Linux computers have software built in to uncompress these files.

It might also be necessary to add ".fits" to the ends of files to make them work in DS9.

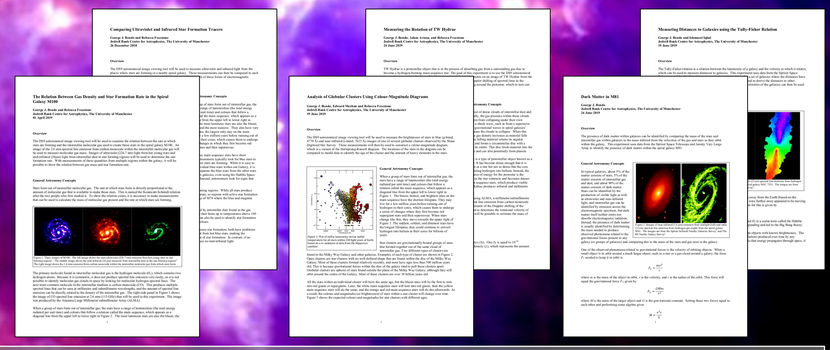
- ESASky

Electromagnetic Spectrum

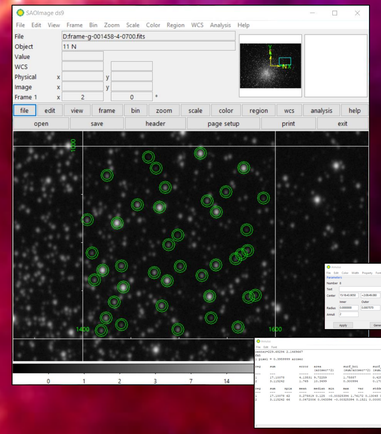
Band	Wavelengths	Emission Sources
Radio	>3 mm	• Supernovae • AGN • Atomic interstellar gas (hydrogen 21cm spectral line)
Millimetre	1 mm – 4 mm	• Ionized interstellar gas • Molecular interstellar gas (CO spectral line)
Submillimetre	250 μm – 1 mm	• Cold interstellar dust • Molecular interstellar gas (CO spectral line)
Far-infrared	50 μm – 500 μm	• Cold interstellar dust
Mid-infrared	5 μm – 50 μm	• Hot interstellar dust • Large interstellar carbon molecules (PAHs)
Near-infrared	780 nm – 5 μm	• Old stars
Optical	380 – 780 nm	• Old stars (red wavelengths) • Young stars (blue wavelengths) • Warm ionized interstellar gas (Ho line, HB line, other spectral lines)
Ultraviolet	10 nm – 380 nm	• Young stars
X-ray	10 pm – 10 nm	• Hot ionized interstellar gas • X-ray binary stars • AGN
Gamma-ray	> 50 pm	• Gamma ray bursts • AGN

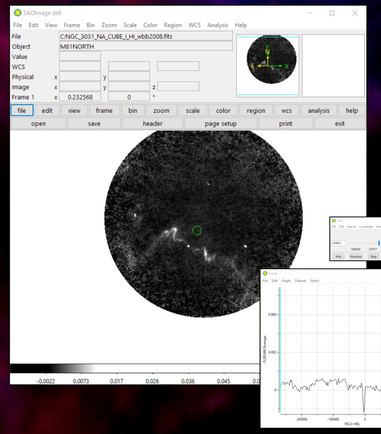
The end of the guide lists links to websites with FITS images, suggested objects to look up on those websites, and information on the electromagnetic spectrum.

Lab Scripts for Secondary School and Undergraduate Teaching



These lab scripts were written (with the assistance of students) as classroom activities that could introduce students to using professional astronomy data. Scripts for secondary school and undergraduate students are currently available. The scripts have been tested with year 12 work experience students, and some are used for teaching at the University of Manchester.





All lab scripts are based on using real science data in the form of FITS images acquired from public archives such as the NASA/IPAC Extragalactic Database and Sloan Digitized Sky Survey.

All analyses are based on using DS9, which is publicly available for free for all computer platforms.

The experiments cover topics such as the measuring stellar ages and metallicities for globular clusters and deriving the Kennicutt-Schmidt relation (the relation between gas mass and star formation rate).

The lab scripts not only provide introductions to these topics but also cover basic concepts such as the electromagnetic spectrum, Keplerian motion, and the expansion of the Universe.