



FAULKES TELESCOPE

Colour Imaging

Introduction, Curriculum Links & Teaching Strategies



Education and Culture

Socrates

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Colour Imaging

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Introduction

Colour imaging is something that many astronomers never really do! They are often very much involved with the processing of the raw data from the telescopes that producing a colour image of their object is not something they need to do or even necessarily have the right images to do.

The images produced by NASA/ESA and other astronomy related organisations for publicity materials are usually produced by teams of people whose job it is to produce pleasing images from the scientific data that is obtained by the astronomers.

However, there is quite a lot of science that can be obtained from looking at the process of how a colour image is produced.

In this project we will look at how colour images can be produced from astronomical data, and also look at the way in which these images are then displayed on computer screens and also on printed materials.

Professional research class telescopes have professional CCDs (charged coupled device), which is a camera that converts the light from astronomical objects in to the images and data we use. However, this camera is not like an ordinary consumer digital camera, and cannot take colour images in a single shot. There are some very good reasons why this is the case, and you can read more about these in the document "Colour Imaging and CCDs".

To produce the colour images you see when using professional telescopes, the Faulkes telescopes take three individual images of your chosen astronomical object through three coloured filters (red, green and blue). The telescopes then combines these images to make a colour image that it can send to you almost immediately after the observation has taken place.

These images are often of a very high quality, but they are really only "quick look" images, and better images can usually be produced if you process the original data files yourself.

FITS (Flexible Image Transport System) files are a special file format used by astronomers for the storage of data from telescope cameras.

In this project you will learn how to convert the original data from the telescope in to something that is useable in a standard photograph processing program and then converted in to a colour image.

Curriculum Links

Possible Curriculum Links

- Light, colour, reflection, refraction, mirrors, additive and subtractive filtering.
- CCD cameras, digital photography, electrons, photons, charge, binary code.
- Art and design, colour, shape and form, photography.
- Using computers to manipulate data.

For country specific curriculum links, see your local curriculum guidelines.

Learning Outcomes

In carrying out this project students will:

- Understand that light is gathered from an astronomical object and focused on a CCD camera.
- Know that CCD cameras convert photons to charge that is then read out by a computer.
- Learn why a professional research class telescope needs a CCD sensitive to a wide range of frequencies of light.
- Understand how a computer records data from a CCD in to a computer file for storage.
- Know how to process FITS files to see images of astronomical objects.
- Know how to produce a colour image from processed FITS files using software.
- Understand how colour images are displayed on computer monitors and printed out on paper.

Teaching Strategies

Introducing the Project to Students

Many students will have used a digital camera before, and certainly they will all have watched television at some point or other in their lives. This project provides the opportunity to look carefully at how we produce colour images in our everyday lives, and apply that knowledge to the colour imaging done with a research class telescope.

You can introduce this project from a number of angles. Clearly light, colour and imaging are part of science courses and the physics associated with CCDs is more likely to be studied at an advanced level. Whilst it is clear that this is a science based activity, it is also very relevant to arts based subjects. The colour, shape and form of astronomical images are clearly relevant to the arts curriculum, and the processing of a colour image is very much a personal thing where the individual astro-imager will process his or her FITS files to their own particular subjective taste.

It is often said that processing a FITS file to produce a colour image often destroys the scientific data in the image. Whilst it is true that the pixel values are dramatically altered, and it would not be possible to do a numerical scientific analysis of the data recorded by the camera, it is also true to say that in revealing the beauty of astronomical objects there is a lot of science that can be talked about. You can find more information about interpreting your colour images in the document "Looking at Colour Images".

Sample Data Sets

You will find sets of sample data in the pack from which you got this document, and that will allow you to try out processing some FITS files and making colour images before you plan to do your own observing and process your own FITS files.

Planning

In planning you will need to decide on what objects you want to image. You could decide on these by using the Internet to find images taken by other telescopes. Remember to take into account the field of view of the telescope you will use, and the size of your planned targets to make sure they will be visible.

Observing

During your observing session you will need to refer to your observing log where you will have planned which objects to acquire images of.

Analysing/Processing

This part of the project is where you will follow the instructions in this pack that explain how to go about processing your data files to produce a colour image using SalsaJ. You should take careful note of any specific problems you have with the images, or any particular features of your images that stand out.

Evaluating

Once you have completed your colour processing, it is worth looking back at the procedure you carried out to see if there was anything that you think went particularly badly that you could improve, or anything that you did that went very well that you would like to try again or even improve upon.

What you will need to know in order to carry out this project.

In order to carry out this project you will need to be able to do or understand the following:

- The procedure for producing a colour image from FITS files with SalsaJ.
- How to plan for an observing session, including appropriately sized objects and required exposure times.
- How to plan an observing session so that the time is used appropriately and efficiently.
- How to set up and use the software package mentioned in this project.

Generic skills you will need to use are:

- Understanding how to use celestial co-ordinates.
- How to use a telescope to image an astronomical image.

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