

### Summary

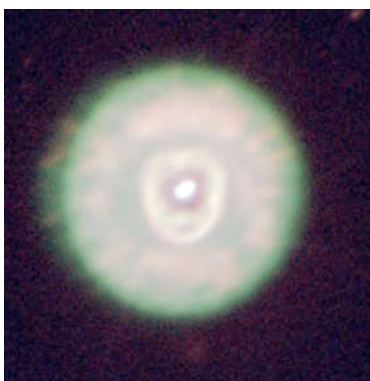
This is a straightforward project to image a number of planetary nebulae in colour. Despite the name, a planetary nebula has nothing to do with planets. It is the shell of brightly glowing gas that is left, expanding out into space, when an average sized star runs out of nuclear fuel and loses its outer layers. Many planetary nebulae are extremely beautiful objects.

Students can make basic measurements of their planetary nebulae using a simple spreadsheet based measuring tool, the Jpeg Viewer.

### Planning

1. **Look at calendar** Choose an observing date and time when the Moon is not visible (because the glare it creates swamps images of faint, extended objects like nebulae).
2. **Book** Book your observing slot.
3. **Choose targets** Once you know when you will be using the telescope, you can choose a number of planetary nebulae to observe which will be higher than 30 degrees above the horizon (so that the atmosphere does not cause a lot of absorption).

To find suitable objects for any time of the year use the Faulkes Observations Planner (or planetarium software). In a half hour session you should be able to obtain a dozen or more images, assuming that each takes about two minutes, including the time for the telescope to slew from one target to the next.



### Observing (obtaining data)

1. **Observe** Use the telescope to get a colour image of each planetary nebula. Use an exposure time of 10 seconds for each of the separate red, green and blue component images.
2. **Save** When your observing session is over, you will be taken to a web page with thumbnails of all the images you have obtained. Click on each of these in turn. This causes a larger version to open on screen. Hover over each larger image using the mouse, and when the 'save' icon appears in the top left hand corner, click on this and save the image to a suitable place on your hard disc.

## Analysing

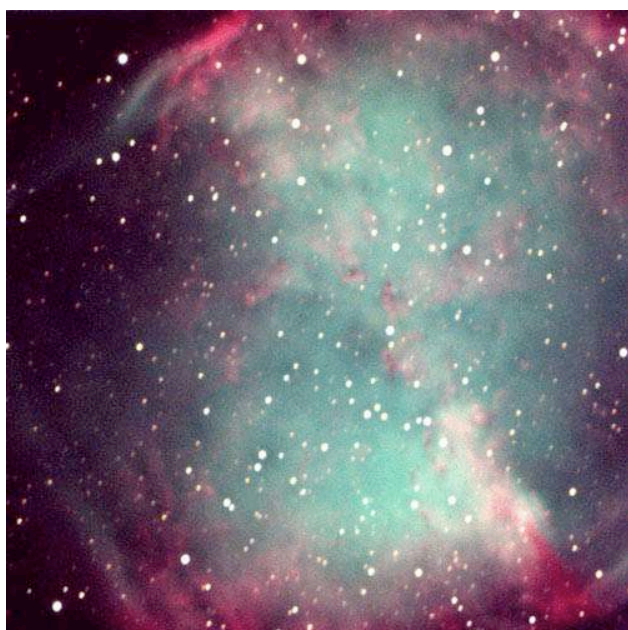
### Studying your planetary nebulae

1. **Print** Open each of your colour jpeg images in a program like *Paint Shop Pro* or *Photoshop Elements*, and print it out using the best quality available to you.
2. **Read** If you haven't already read about what planetary nebulae are and how they are formed, do so now, for example, using the article by Carole Stott referred to above under 'Resources'.
3. **Examine** Examine each planetary nebula carefully, looking at the overall shape, the colours, and any other features you can see, (for example some nebulae have several shells of glowing gas, while others have 'fingers' inside them).
4. **Write** Describe your observations in your own words.



### Measuring your planetary nebulae

1. **Open viewer** Open the *JPEG Viewer* spreadsheet.
2. **Get image** Click the *Get new image* button in the toolbar and open each planetary nebula in turn. For each follow the next few instructions.
3. **Measure** Use the green shape buttons in the toolbar to make different measurements, (e.g., how big is the planetary nebula in arcminutes? Can you see shells of glowing gas which look either circular or elliptical? Are there any other features that you can measure?) For further details on using the JPEG Viewer, look at the instructions.



## Evaluating

1. What factors might have limited the quality of the images you obtained, for example poor atmospheric seeing conditions, bright moonlight, twilight?
2. Are there any ways that you would improve on what you have done if you were to do the project again using the same target planetary nebulae? For example, would you use different exposure times or different filters?
3. Can you think how you might learn more about the planetary nebulae you have imaged by using different filters (broadband and narrow band)?