

Astronomy 16 – Astrophysics: Stars, ISM, and Galaxies

Fall 2017

Lab 3

by Wednesday, October 26

Introduction and Outline

Students will work in groups of two or three to plan and carry out observations of an extended object of their choice, with the goal of producing a (likely color composite) image and using that image to answer a simple, empirical question about their object.

The data reduction and analysis techniques that will be used are the same as those employed during the first two labs – so the manuals and supplementary material provided for those labs should be consulted for information about how to reduce and analyze image data taken with the Peter van de Kamp Observatory.

Students will be provided with a list of viable objects (bright and angularly big enough to produce a reasonable image with our observing set up in one night of observing or less, and up for at least a few hours a night during the fall). They are encouraged to do a little reading (and image-looking) on the Messier Monday blog and Astronomy Picture of the Day (among other places) to find out about the object they choose and to inspire them to pose a question their observations can answer and then to plan the observations that will enable them to produce a useful image (so, exposure time, filter choices – the instructors will help with these decisions).

Students will form their own groups or be placed into groups based on the objects they choose to observe. They will then meet with the lab instructors (Mary Ann Klassen and Prof. Cohen) as a group, go over their plans for the observations, discuss the question they hope to answer, and learn how to set up their observations. This work will be done on a group-by-group basis in the afternoon preceding a night with good weather. The data will be made available to the group the next day and then each student will reduce the data themselves and produce their own image and write their own report, in which they present their image and attempt to answer the question they've posed. Members of a group can work together and help each other, but the write-ups will be individual work.

The goal is for all student groups to make their observations in the next two weeks (so, before fall break starts) and then to reduce and analyze their data and have their write-ups done by the Wednesday after fall break. We can start as soon as Monday, October 3 – the weather is supposed to be good the first few days of the week. Students should not wait too long to make their observations as bad weather can strike at any time!

Reading

Students will want some information and a sense of what their object looks like. We recommend you read over this list of possible objects to observe:

http://astro.swarthmore.edu/astro16/labs/Astro16_Fall2017_lab3_objects.pdf

And then look up information about individual objects on Messier Monday:

<http://scienceblogs.com/startswithabang/?s=messier+monday>

You may need to search around a little to find the object you're looking for.

And Astronomy Picture of the Day:

https://apod.nasa.gov/cgi-bin/apod/apod_search

In the course of doing this work, we may have you read a little more from Ch. 6 of the textbook. And we may have a lab meeting the first Monday after fall break, to discuss this material and provide help with your data analysis and image processing (and question answering).

Procedure

By Thursday (but absolutely earlier if you can) students should individually email Prof. Cohen with their choice of object and a preliminary idea for a question they can answer about the object based on their image.

Questions that can be posed and answered include things like:

What is the size of the object (similar to what you did for the Ring Nebula in the last lab)?

How can the color variation in the object be quantified (also similar to what you did with the Ring Nebula)?

Questions about the symmetry and shape of an object.

Detectability of particular features (spiral arm structure in a spiral galaxy; central star of a planetary nebula).

Tilt angle of a galaxy (if it's assumed to be circular but looks oval projected on the sky, we can de-project it to determine its tilt with respect to the Earth).

Depth of a crater on the Moon based on the length of the shadow of its wall in the crater itself.

In principle, some questions can be addressed with multiple observations spread over time (though mostly we can think only of questions about the Moon's illumination that can be addressed with multiple observations taken over a period of a couple of days or weeks).

Let us know if you have any other ideas. There are many interesting questions one can pose about astronomical objects, but not all of them can be answered with simple imaging observations, although a lot can.

Your write-up should include

A short introduction that describes the object you've chosen to observe, the facts of your observations (when they were taken, what filters and exposure times), and a statement of the question you are addressing with your observation.

Your final image (you do not need to include a detailed description of the reduction and color compositing, as you did that in the last lab) and any analysis of that image you've done in order to answer the question you've posed.

And an attempt to answer said question.

We assume that this write-up will be relatively short.