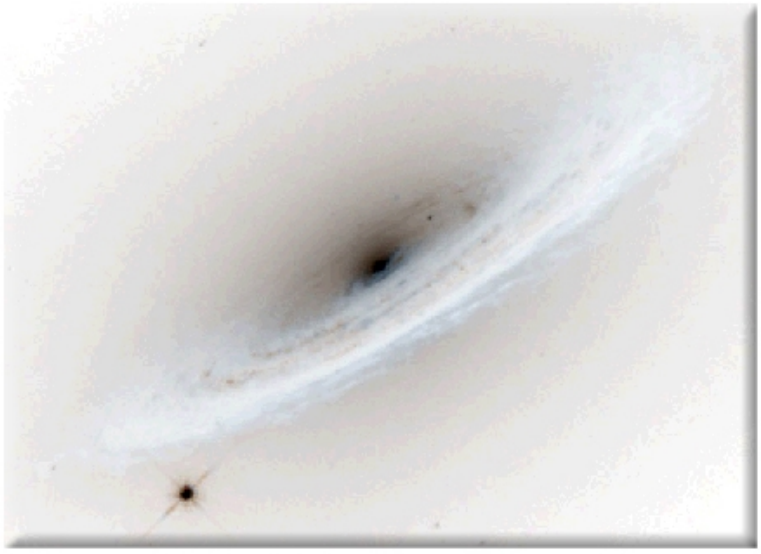
Student Research Team of:

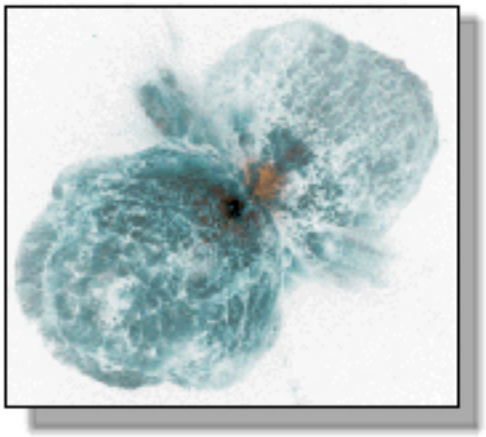
_____ _____

Deep Sky Astronomy



Deep Sky Astronomy

Deep Sky Astronomy Inquiry Unit



Part I: Introduction to Inquiry

Where will humans find their future adventures? With every inch of this planet already under their control, humans will be looking in several directions. Some of those directions might include the curing of our planet's environmental ills or doing a "make-over" on the human species by genetic manipulation. Another direction will be to investigate the human mind. A fourth direction will be the frontiers of space.

We are at the boundaries of that mysterious realm... A realm that we humans are becoming quite familiar with. A realm that we have developed our past legends, history, travels, and dreams around. Even though it is so distant from us, our creativity, ingenuity, and intelligence has given us the ability to peer into that realm. So... let's see what is there.

In this unit we are going to venture out into and examine the awesome mysteries that exist in deep space. The first part of the Astronomy unit will be to help you devise a research project. This part will consist of movies, internet searching, labs, general research that will build up you background knowledge. The second part will consist of you and your partner carrying out your Deep Sky Astronomy investigation and research by using the MMSD 16" Remote Telescopic Observatory, and our new partner telescope at the Sydney Observatory in Australia. Both sections will have labs, projects, investigations, and night observation activities. I ask you to move from the bonds of Earth's gravity, and release your imagination into the depths of space.... it must be quite exciting out there!!!

Part II: What is Deep Sky Astronomy?

Have you ever wondered where our solar system came from, or... what is going to happen to it when it dies? Have you ever wondered what a galaxy was, and where we are in one? Or did you ever wonder about black holes, brown dwarfs and what other weird things are out there? As you look at the night sky, do you wonder as all humans have done, "Are we alone?".

Deep Sky Astronomy is the science that deals with objects beyond our solar system of SOL which includes 9 planets, 1 star, and minor planetary satellites. The chart on page 3 will give an idea of all that makes up this adventurous type of astronomy.

Part III: The Process...

1). Like all research investigations, you need to gain some basic background about the topic. This will help you narrow down your ideas into a researchable question. The first part of this process is to use the key to Deep Sky Objects to narrow down your research question.

2). Once you have narrowed down your general topic, it is now time to construct a list of references from the library, internet, classroom materials, and other things to establish a base of knowledge.

3). Once your list has been established, notes should be taken. When taking the notes, list questions that come to mind. All this will help you develop a research question.

4). Once that basic knowledge has been obtained, the research question and hypothesis can be formulated.

5). Now you must do research to see what is available on the internet, books, etc. dealing with your specific question. This will lead you to a researchable hypothesis and knowledge as to the image you need to request.

6). Now that you have your research question finished and a hypothesis answering that question, it is time make a list of images you will need as data to test your hypothesis.

Deep Sky Astronomy

7). Next you will need to know what region of the night sky will be available to you for images. Use a Planosphere Sky Chart to determine what constellations will be up at this time of year and at what time of night they will be available to image.

8). Using the MAG 5 & 6 Star Charts, Norton Star Atlas, Burham's Guide to the Stars, and The Sky computer software, develop a list. These references will give you a much more in depth look at the sky. Determine what objects are the type you need for your research.

9). Develop a list of these objects with their coordinates, Right Ascension and Declination. (They're like latitude and longitude of the night sky)

10). On a clear night, our student technicians and I will meet you at school to link you to the 16" telescope and CCD camera for your imaging session.

11). Once the images have been taken, you must use the images, background information, etc. to make a project display of your research. This research will be displayed for the Environmental Conference in May.

Part IV: What are some of the objects you can investigate?

Key for Selecting Deep Sky Research

To help you understand what these different objects are and where they are located, do the WHAT ARE DEEP SKY OBJECTS worksheet at the end of your packet.

1. Within our solar system ... Asteroids
1a. Outside our solar system.... Go to 2

2. Within our galaxy... Go to 3
2a. Outside our galaxy... Go to 11

3. Pertaining to single star solar systems... Go to 5
3a. Pertaining to groupings of stars... Go to 4

4. Large circular, compacted grouping of 10,000's of stars... Globular star cluster
4a. Loosely connected grouping of 1000's of stars... Open star cluster

5. Visually existing star systems... Go to 9
5a. Birth and Death of star systems... Go to 6

6. Birth of star systems... Go to 7
6a. Death of star systems... Go to 8

7. Large clouds of matter illuminated by stars being born within... Diffused Nebula

7a. Large clouds of matter illuminated by light behind them... Dark Nebula

8. Evidence of huge star (supernovae) explosion... Planetary Nebula (Crab)
8a. Evidence of large star (novae) death... Planetary Nebula (Ring)

9. Solar systems with more than one star... Binary Star Systems
9a. Solar systems with one star... Go to 10

10. Stars that have different colors, size and temperatures... Go to 17
10a. All other stars... Go to 18

11. Groupings of galaxies... Go to 12
11a. Single galaxies... Go to 13

12. Galaxies that are colliding.... Interacting Galaxies
12a. Galaxies that are in close together... Galactic Groups

13. Early Galaxy Formation... Quasars
13a. Already Formed Galaxies... go to 14

14. Galaxies with arms... Go to 15
14a. Galaxies without arms... Go to 16

15. Galaxies with bar.... Spiral Bar Galaxies
15a. Galaxies without bar... Spiral Galaxies

16. Galaxies that are elliptical or circular… Elliptical Galaxies
16a. Galaxies that are not elliptical or circular... Irregular Galaxies

17. Huge stars ready to die.... Supergiants, Giants Stars
17a. Stars like ours... Main Sequence Stars
17b. Small stars... Dwarf Stars

18. Stars that change in light intensity over time... Variable stars
18a. Stars that are left over after novae... Pulsars and Neutron stars

19. Objects with long tails... Comets
19a. Objects without long tails... Asteroids

DEEP SKY ASTRONOMY

Part V: Background Information...

Step 1: Go through the above chart and select the general topic of interest.

Write your general topic below:

_____

Step 2: Now go to the LMC, Internet, and other sources of reference and build a bibliography of useful materials. List at least 6 below:

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

Step 3: From the research references, list some keywords that you can use to pull up information on the internet:

_____

_____

_____

_____

Step 4: List any videos or other multimedia resources that will help you.

_____

_____

Step 5: At this point, go to the internet and do the "Hubble Deep Field Academy" activities to find out about the Universe.

Your answer sheets are at the end of this packet. The address is below. When you are finished with each of the 5 activities, show your worksheets to your teacher to be initialed.

Go to:
http://amazing-space.stsci.edu/hdf-top-level.html

Get Oriented
Stellar Statistician
Cosmic Classifier
Galactic Guide
Universal Graduate

Step 5 1/2: Also go to the internet and do the "Galaxies Galore" activities to find out about galaxies.

Your direction sheets are at the end of this packet. The address is below. When you are finished with each of the activities, show your worksheets to your teacher to be initialed.

Go to:
http://amazing-space.stsci.edu/galaxies-galore/index.html

Step 6: From the references you listed earlier, take one page of notes on your topic.

Step 7: State below in detail your research question.

My research question is: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

DEEP SKY ASTRONOMY

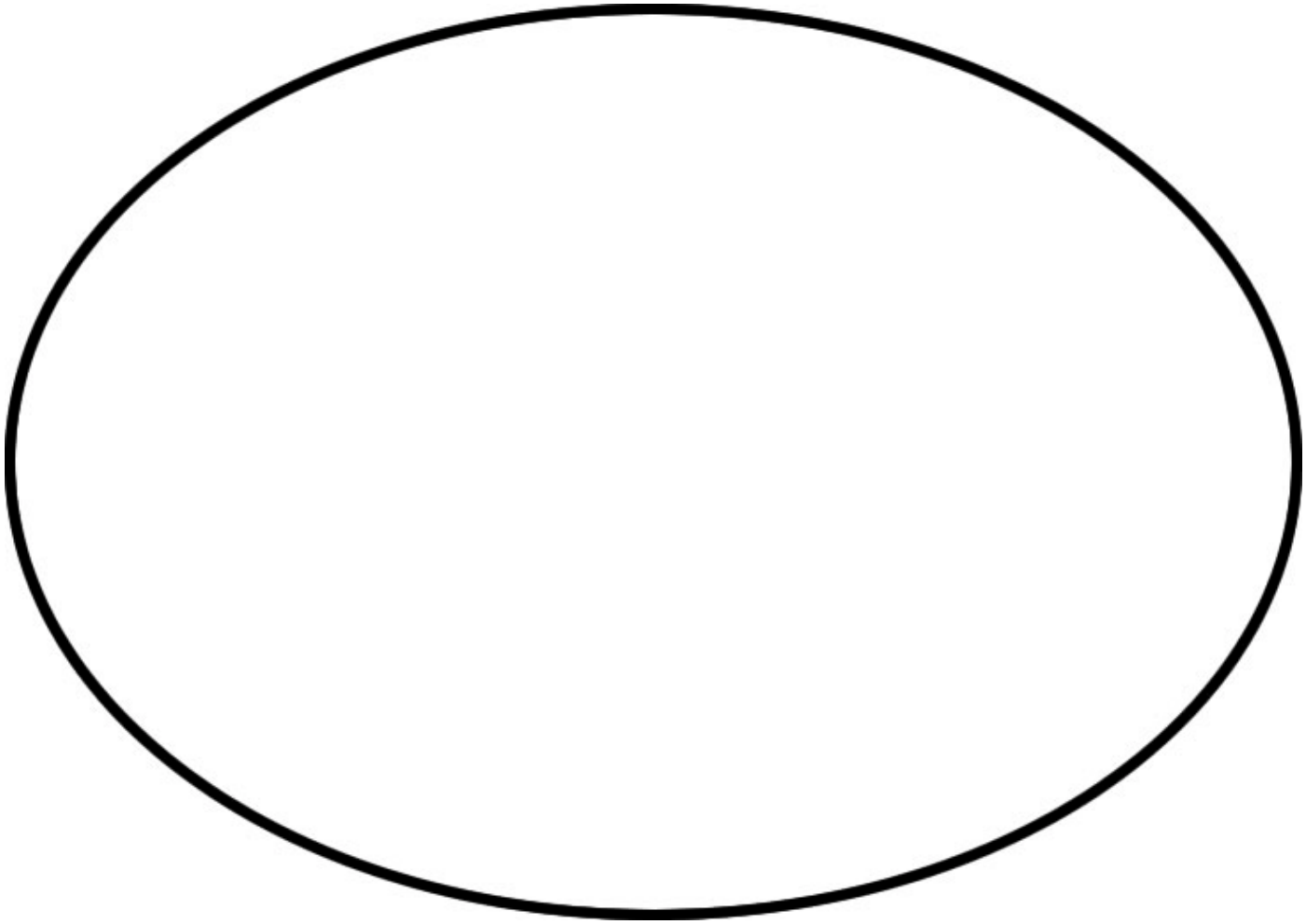
Step 8: Take 2 to 4 pages of notes on your topic and research question. From this background, state below in detail your research hypothesis, and give the reason why you have decided on this hypothesis.

Part VI: Specific Research Information

The night sky is very large, and it continually changes. The sky in Jan. will be very different than the one in July, and the one at 7 PM will be very different from the one at 4 AM. Therefore, we must use some very handy astronomy tools to find out what actually is up and when.

Step 9: **USING A PLANOSPHERE...**
This circular device will tell you which constellations will be found at what time of night on a specific day. When you are ready, obtain a planosphere from an instructor or one of the techs. See if you can figure out how to use it. If you have problems, check with a tech or myself.

1. Label North, East, West, & South.
2. Draw in your azimuth line.
3. To help you understand what a constellation is, do the worksheet at the end of your packet.



DEEP SKY ASTRONOMY

Step 10: List below 8 major constellations that are found tonight / this week.

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________

Step 11: In the oval below, draw the constellations and their position in the night sky for this Day ________________ and Time ______________.

Step 12: To help you understand how we know where the objects in the night sky are, do the worksheet:

THE LONGITUDE & LATITUDE OF THE NIGHT SKY: DECLINATION AND RIGHT ASCENSION

Step 13: Now we must find what objects of the deep space kind are in those constellations. For this we will use a more detailed STAR CHART called a MAG 6. These star charts will give us a lot of good detailed information.

• We must first locate the page of the chart that will be visible this week.

• Now familiarize yourself with the deep sky symbols for, double stars, nebulas, planetary nebulas, galaxies.

• Finally, go to each constellation on the page that is of the type you wish to image. Write down the information below.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Constellation

____

Object type ______________________

Name of Object	RA	DEC.

Step 14: Wow, these are a lot of objects to image! How can we narrow them down to a useful few?

1. ______________________

2. ______________________

3. _____

_____

Step 15: Requesting your photos & planning your observation session...

This form is important to fill out because it will help you decide if you should request an image of the scope or if you can take the image through the computer. All drawings should be as accurate as possible. For some of this information, you will have to go to THE SKY software.

Request Number: _____ **Request By:** _____

Common Name of the Image: _____

Messier Name of Image (if it has one): _____ **NGC number of the image:** _____

Type of Deep Sky Object you are taking: _____

Magnitude (apparent brightness) **of the Image:** _____ **Constellation Image is in:** _____

Right Ascension of Image: _____ **Declination of Image:** _____

Reason(s) for taking this image:

Diagram below the constellation the image is in, and show as accurately as you can its position in that constellation.

Approximate time of night this photo would be taken: _____

Can we take a evening or will we need to request the picture of this image telescope to take it later in the evening? _____

Signature of Technician: _____ **Teacher's Initials:** _____

Once you have decided on the above information, you need to schedule a time and night to come in and take your image. If you can't come in, then give your request to your teacher.

Date & Time: _____

DEEP SKY ASTRONOMY

Part VII: The Final Product

Your final product of this investigation will be to make a project display of your research and results. Communications is an important part of science. The display will be the way you will communicate your research.

Step 1: How the Display must be organized...
Below is a diagram of how you can organize your display.

Step 2: What should be in your display...
The outline below and on the next page will help you in knowing what topics to write about and put on your display.

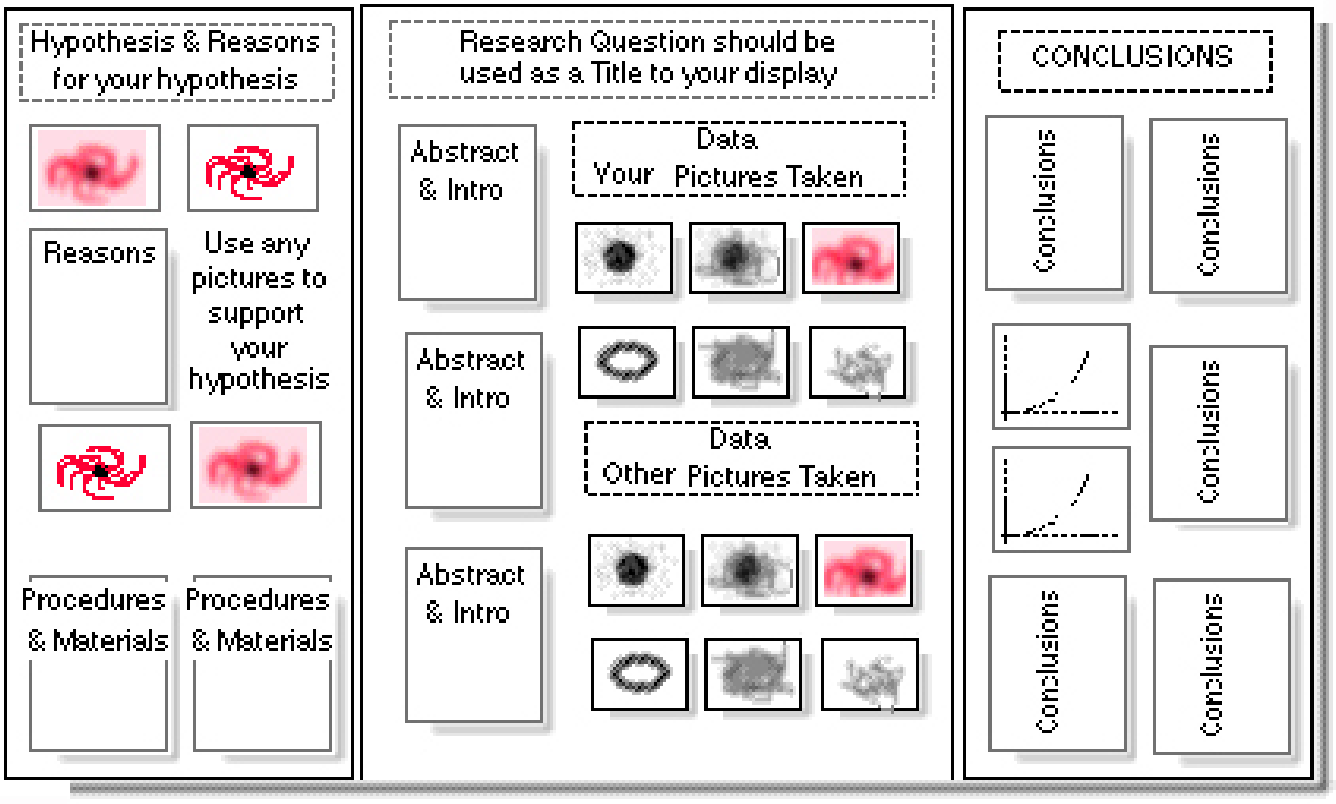
The display should have all parts of the scientific process you followed. For example, Background Research, Question, Hypothesis, Data charts, Annotations of data, Conclusions, and any new questions you might have after doing your research.

Abstract:

Introduction information:

In this section you should include this information. Remember that this section is important because it introduces and gives the reader the background needed to understand your entire research project.

1. What are the different kinds of Deep Sky Objects?
2. How are they different from Solar System Objects?
3. How are measurements made when dealing with deep Sky objects?
4. What is a astronomical unit (AU), light-year and a parsec?
5. How can we tell deep sky objects are moving towards us or away?
6. How do we determine where in the night sky these objects are?
7. What is a constellation?



8. What is Right Ascension and Declination? Diagram and describe...
9. What is a planosphere and how does it work? ...what are Star charts?
10. What is meant by apparent magnitude and absolute magnitude?
11. What is Remote Astronomy and what is unique about it?
12. Describe to the reader the distance relationships of the different deep sky objects. Ex. Where are galaxies in relationship to the universe?... where are diffused nebulas in relationship to galaxies?
13. Describe how your research is connected to these deep sky objects.
14. Add any other information you feel a reader would need to understand your research.

Question:

You should state clearly the main question that you are trying to answer, but also include several minor questions that you investigated during this study.

Hypothesis:

Tell all you know about the topic of your question and then make your hypothesis. Give reasons (backed up by info) for your hypothesis. Describe how your hypothesis is testable.

Procedures:

In past lab reports this section was a minor part. In this lab report it is a major part, because of the integration and details that went into getting you image.

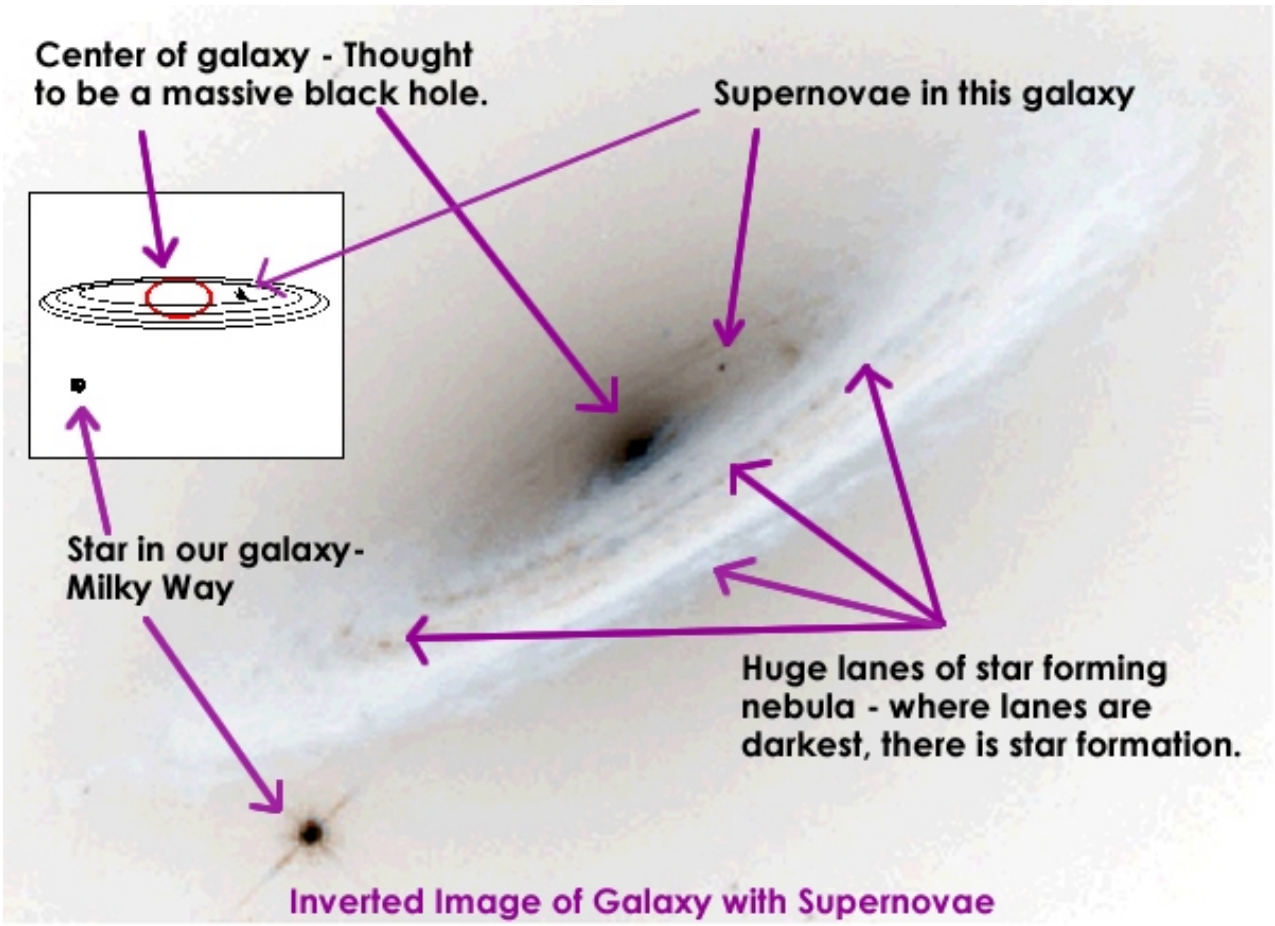
Materials:

List all the items used in the investigations. Make drawings of any items you have used for the first time.

Data:

These items should be part of your data:

1. All remote digital image(s) you acquired.
2. All images acquired from books and internet..
3. Drawings and diagrams
4. Charts and tables
5. All remote digital images must have labels, RA and DEC, and constellation locations, etc.



Inverted Image of Galaxy with Supernovae

DEEP SKY ASTRONOMY

Conclusions:

The conclusion will be broken down into several categories. Use the questions listed below to help you write paragraphs on the different categories.

A. Analysis of data

1. Annotate your remote digital images. What image is it? What are the different regions of the image? What stars are visible? What is happening in the image? Create diagrams of the image to show this annotation. (An example of how this should be done on the next page.)

2. Annotate all other images that you have gotten off the internet or copied from books. What are they? What are they showing?

3. Annotate both types of images with the idea of showing how they prove or disprove your hypothesis of your research question. How are these images unique and helpful in answering your research question?

4. After annotating the images, write several paragraphs detailing what conclusions you made from them about your research question and hypothesis. What reasons can you give for making these concluding statements (From the images, describe any details that back up your conclusions)?

B. Comparison to your hypothesis

1. How did your conclusions drawn from your images compare to your support or not support your hypothesis?

2. Are there any other consider-ations that should be made in doing this investigation?

3. How did this research project increase your knowledge about deep sky astronomy, remote digital astronomy, and space science in general?

C. Analysis of Techniques

1. What problems did you run into while taking the data? Where in the process of getting and researching your question, did you run into trouble, not understand, or make an error?

2. As you were researching your question, did you create or think about any new research questions pertaining to the study?

3. Were you able to achieve your purpose for doing the investigation and the research? Explain.

