

Scanning Across the Spectrum

Overview: We're going to use some software developed by the European Space Agency (ESA) to view data of distant galaxies. We'll be able to switch between different wavelengths to see different parts of the galaxy light up. At first your goal will be to explore two galaxies using different kinds of wavelengths and take notes and photos of what you find. In the second half of the assignment, you'll be tasked to summarize your findings as you describe the two galaxies, and then compare and contrast what makes the galaxies different. Part of the goal today is to deliberately practice your writing skills, so expect to put in effort to write a couple paragraphs today.

Part 1: We are going to use software made by the ESA to view different galaxies using photographs from a variety of types of telescopes. We will focus on two Galaxies today: M 31 (young galaxy) and M 87 (old galaxy) to see how the galaxies have different shapes, but also because of their age difference they have different types of stars spread throughout them. **For each galaxy you will use a variety of types of light to investigate what stars make up the galaxy and record this using a screenshot and a description.**

1. Open up this link here: <https://sky.esa.int/esasky/>
2. Then click **EXPLORER**
3. Use the table below to help you make sense of what you see in the photographs.

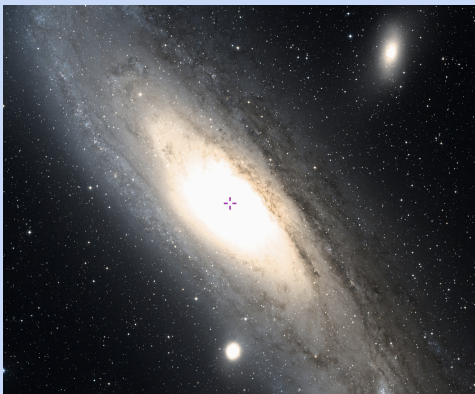
Types of Light and Objects that Produce Them		
Type of Light	Temperature (K)	Typical Sources
Gamma Rays	$> 10^8$ K	Matter falling into Black Holes
X-rays	$10^8 - 10^6$ K	Supernovas
Ultraviolet	$10^6 - 10^4$ K	Very Hot (and young) Stars
Visible	10000 - 1000 K	Cool (medium to old) Stars
Infrared	200 - 1000 K	Cool Dust and Stars Forming
Microwaves	10 - 200 K	Cosmic Microwave Background
Radio	< 10 K	Extremely Cold Dust

4. For Both galaxies use the software to view the galaxies using the following types of light. Switch between the types of light by clicking the icon in the top left corner which is three colored diamonds. Click the drop down menu on the left and select the light setting you are looking for.

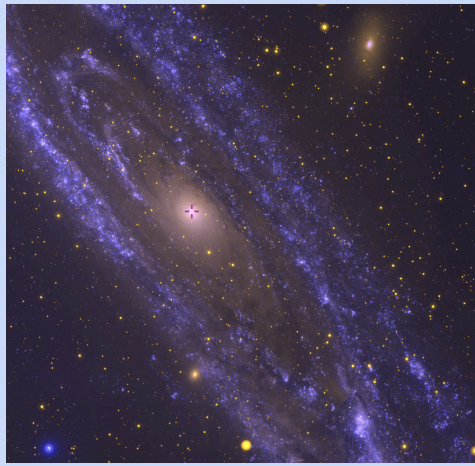
Light Setting in Software	Part of EM Spectrum
Optical	Visible Light
Ultraviolet	Ultraviolet
Soft X-ray (M87 will need to zoom out)	X-rays (lower energy)
Far Infrared	Infrared (lower energy)

5. For each galaxy and type of light:

- Get a screenshot with the camera icon (like this ) in the top right corner. **And then upload it into this document.**
- Describe with your words where that type of light is showing up in the galaxy
- Describe with your words what type of objects are the likely source of the light (table above to help)
- **And in the visible light section**, describe the shape and overall look of the entire galaxy

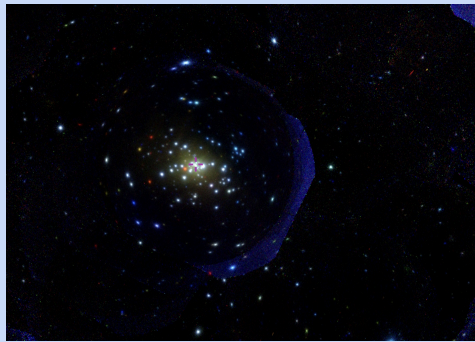
M 31 - Spiral Galaxy - Younger galaxy		
Type of Light	Screenshot of the Galaxy	Description
Visible		Describe the Galaxy and where this light is coming from. spiral shape, most of the light is coming from the center Describe what kinds of objects are a source for this light. Many cool medium stars

Ultraviolet

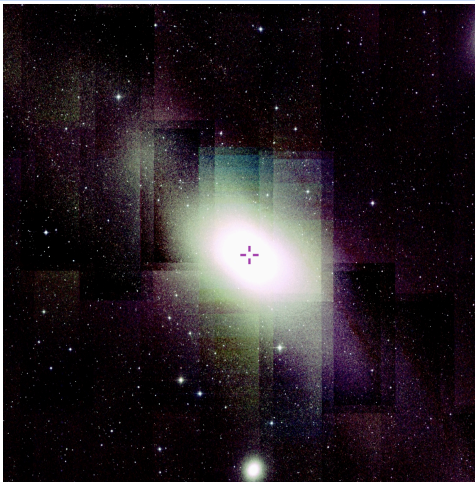


Describe the Galaxy and where this light is coming from.
A lot of purple rings around a small center, the light is coming from the rings
Describe what kinds of objects are a source for this light.
A lot of very hot young stars

X-rays

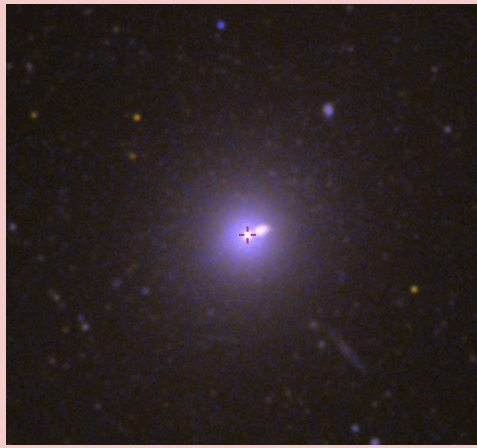


Describe the Galaxy and where this light is coming from.
A circular shape, with many small light sources from the center
Describe what kinds of objects are a source for this light.
A few supernovas

Infrared		Describe the Galaxy and where this light is coming from. Shaped like a diamond, and very colorful most of the light is coming from the middle Describe what kinds of objects are a source for this light. A lot of dust and stars forming
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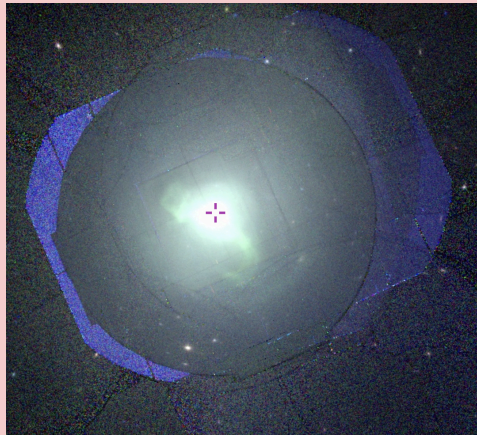
M 87 - Elliptical Galaxy - Older galaxy		
Type of Light	Screenshot of the Galaxy	Description
Visible		Describe the Galaxy and where this light is coming from. Elliptical shape, tons of light coming from the center not much from other places Describe what kinds of objects are a source for this light. A lot of cool medium stars all in the middle

Ultraviolet



Describe the Galaxy and where this light is coming from.
Small purple dot, most of the light is from the center
Describe what kinds of objects are a source for this light.
A few hot young stars

X-rays



Describe the Galaxy and where this light is coming from.
A green blob, with light coming from everywhere but mostly in the center
Describe what kinds of objects are a source for this light.
A massive super nova

Infrared



Describe the Galaxy and where this light is coming from.
A bright dot, with colorful dots all around it, the light is mostly from the center
Describe what kinds of objects are a source for this light.
Cool dust around a star forming

Part 2: In this section you will write about three paragraphs. I want you to summarize with your words what you found above about each galaxy. So one paragraph per galaxy. Then in your third and final paragraph compare and contrast what makes the two examples different. Try to show what appears to change as a young galaxy (M 31) ages into an old galaxy (M 87). At this point you have all the data you need to start, you just have to summarize what you have found and explain what makes the galaxies different.

M31 is shaped like a spiral. Most of the light is in the middle, but there is still large amounts of visible light around it. M31 has a white center with tan and grey surrounding it. There are tons of stars in the galaxy and they are very bright. Most of the light is visible, ultraviolet, and infrared. With only some x-ray.

M87 is shaped like a circle. Almost all of its visible light is concentrated in the center. It has a white center with yellow edges. There appears to be some dim stars in it. Most of the light is x-ray and infrared. The galaxy looks like most of everything in it is in the center.

M31 looks much bigger than M87, more spread out, and brighter. M31 also has much less x-ray light which leads me to believe M87 is having a really big supernova or many small ones going on. M31 has much more ultraviolet light so there must be many more young stars.