

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) (Also this should be the XMM Newton EPIC color option)	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. Describe what kinds of objects are a source for this light.
Ultraviolet		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.
X-rays		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.

Infrared		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.
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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. Describe what kinds of objects are a source for this light.
Ultraviolet		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.
X-rays		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.
Infrared		Describe the Galaxy and where this light is coming from. Describe what kinds of objects are a source for this light.

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.