Exploring Galaxies

Metadata

General Info

Title: Exploring galaxies!

Short description: Students are wondering about characteristics of the galaxies, for example what is the shape of each galaxy and milky way; how many galaxies exist in our universe and other relevant questions. Students in general have not realized the distances between galaxies, or the distances between stars. Performing this scenario, students observe images from James Webb telescope, are using the AAS worldwide telescope and the stellarium where easily can zoom in the sky and explore celestial objects such are galaxies etc. They find the distance of galaxies from Earth; they categorize different shape of galaxies. Additionally, students identify the shape of different galaxies by participating in the citizen science project, the galaxy zoo. Students are working in small groups of four. The didactic scenario is performed using tablets or in the class of computers of the school.

Keywords: observation, galaxy, universe

Educational Context

Age: 12-15

Prerequisites: none

Duration: 3*45 minutes

Educational Objectives

<u>Cognitive Objectives:</u> Students

- identify different types of galaxies
- classify galaxies
- Search distances of several galaxies from Earth
- Compare the shape of galaxies

<u>Affective:</u> Students

- cooperate in groups
- acquire positive interest in science.

<u>Psychomotor:</u> Students
- handle the AAS telescope with accuracy
- use of stellarium software

Connection to the curricula

Astronomy as a subject does not exist in the Greek curriculum. Therefore, with this scenario, students use the AAS worldwide telescope as well as the stellarium software in the class of Geography in Junior High school. They use google earth to explore earth, so, with this scenario as an extension, they can explore the whole universe.

Work sheet

<u>I. Phase of orientation: (45 minutes)</u>

1. See the video on YouTube where the milky way is depicted through the biggest supercluster of galaxies that belongs:
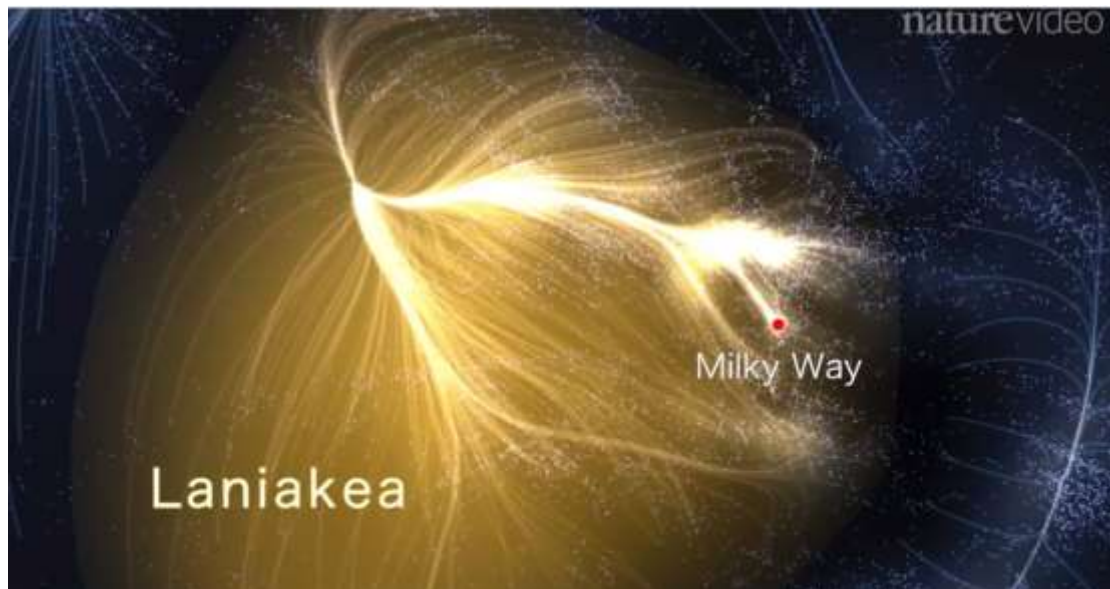   https://www.youtube.com/watch?v=rENyyRwxpHo

Figure 1: Laniakea, our galaxy supercluster, Reference 1

2. Discuss the following questions in your group.
   a) How does the milky way look like for someone outside of the milky way?
   b) How does a galaxy look like?
   c) Have all the galaxies the same shape or not and why?
   d) Do you know how many galaxies and stars exist in our universe?
   e) Can we see a galaxy with naked eye from the northern hemisphere?
   f) From what elements a galaxy is formed?

3. Observe the first image of the James Webb telescope and try to find galaxies on it. (Figure 2) For more pictures from the James Webb telescope open the link: https://webbtelescope.org/resource-gallery/images

Figure 2: First image from the James-Webb telescope, source: NASA.

4. Observe the Hubble's classification scheme in Figure 3. Do you find the same shape in a galaxy of the Figure 2 (James Webb telescope)? (Reference 2 and Reference 3)
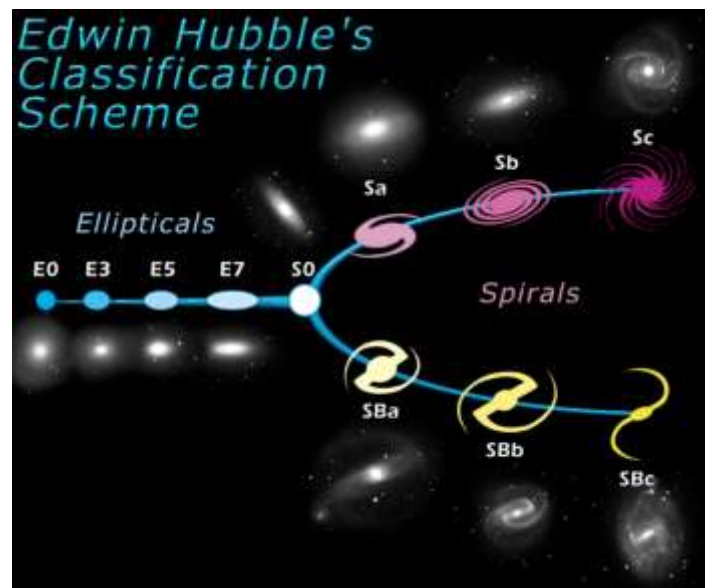

Figure 3: Picture created by NASA and ESA, (public domain).

5. Discuss your findings in the class.

II. Phase of Questioning and generation of hypothesis: (20 minutes)

1. Make a sketch of the milky way, or another galaxy. Explain your sketch.

2. Make a sketch of two different galaxies and think about their distance. How far you must put them to have a realistic depiction?

III. Phase of Exploration and Experimentation (25 minutes)

1. Open the link: http://worldwidetelescope.org/
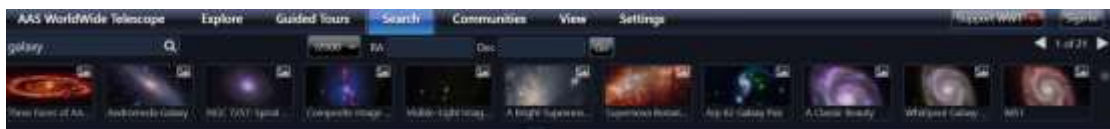2. Observe the upper menu (Figure 4)

Figure 4: Upper menu of the AAS telescope as is depicted in a web browser.

3. Click on the button Search and write the word galaxy. Fill in the next table with your choices for galaxies that you like to explore. Try to find the orientation of each galaxy (e.g., North, in the right bottom corner of your screen, the asterism and the galaxy category)

Table 1:

Name of galaxy	Orientation	Asterism	Category

4. Open stellarium and find for each galaxy of the table 1, the distance from Earth. Fill in this information in the table2. (Reference 4). Which galaxy is more distant from us? Which galaxy is more near to us?

Table 2:

Name of galaxy	Distance from Earth

5. Now you can identify any shape of galaxy! Open https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/ and get start! You observe images from a telescope in Chile. You can continue this citizen science project in your free time.


Figure 5: Galaxy Zoo application in phones and tablets.

IV. Phase of analysis and interpretation (30 minutes)

1. In the phase II you had make several hypotheses, please think, at the end if you changed your opinion.

Hypothesis	True	False
About the shape of the milky way		
About the distances between the galaxies		
About the shapes of other galaxies		

2. Can you find in which category of galaxies belong each galaxy of the Figure 6? Write your answers below of each photo. Do you find that some galaxy is not elliptical neither spiral?
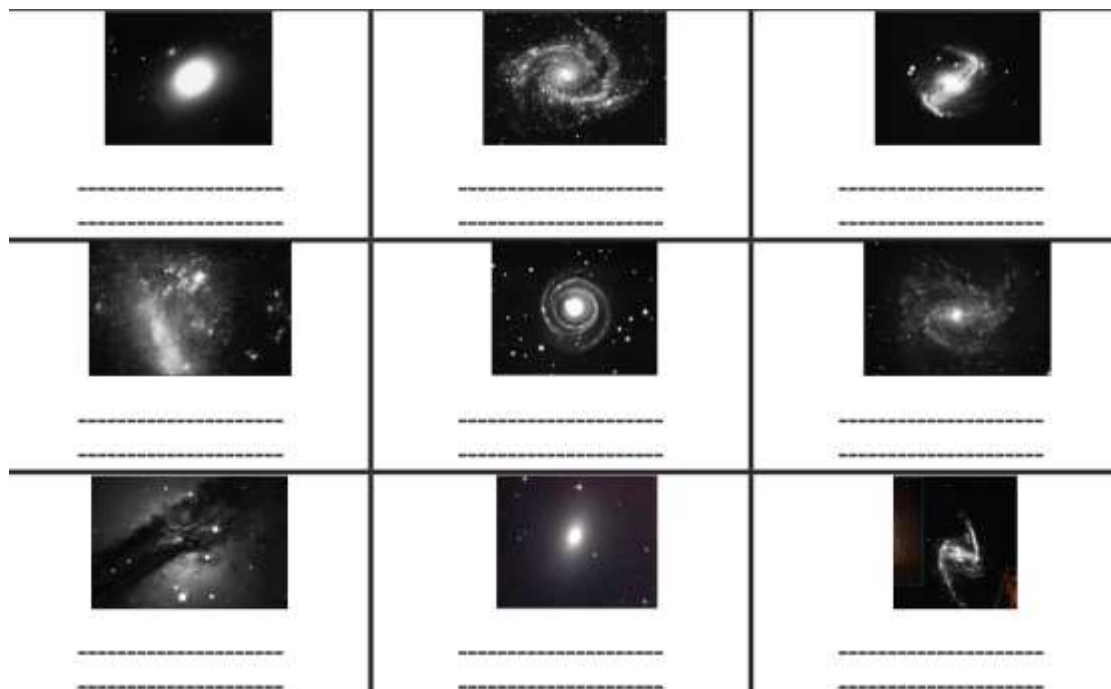
Picture 6: From "The hidden lives of galaxies", Reference 5.

3. Search the word galaxy and/or star in NASA archive: www.apod.nasa.gov and observe different galaxies as NGC 6744, NGC 4945. For example, search ten different galaxies. Which category of galaxies appear more often?

Write here your findings:

4. Open the link:
    https://astronomy.swin.edu.au/cosmos/g/Galaxy+Types#:~:text=Extrapo
    lating%20to%20the%20Universe%20as,30%25%20are%20early%2Dtype
    and find the percentage of each category of type of galaxy. Is this in
    compliance with your survey?

V. Phase Conclusions (15 minutes)

1. Write your conclusions about the project.

2. Did you find any difficulty/ties?

3. What was the most interesting part of the project?

References:

1. https://en.wikipedia.org/wiki/Laniakea_Supercluster
2. https://astronomy.swin.edu.au/cosmos/g/galaxy
3. https://www.rmg.co.uk/stories/topics/what-our-closest-galaxy
4. https://en.wikipedia.org/wiki/Parsec
5. https://imagine.gsfc.nasa.gov/educators/galaxies/imagine/imagine_book_2009.pdf