



## “OUR GALAXIES part 1”

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“Our Galaxies” lesson plan’s aim is to enthuse students about astronomy by introducing the use of robotic telescopes in the classroom. It consists of two parts which can be implemented as a unit in a sequel or separately. In the first part students are asked to work as Scientists and generate a hypothesis about galaxies and their shapes. Students will in teams perform an investigation in the LCO archive to test their hypothesis and discuss their results in the plenary of the classroom. In the second part the students will learn about light and filters while planning their observations with robotic telescopes. They will also use Gimp to edit the images and showcase their work and what they have learnt in an exhibition in their school for their classmates and the local community.

### EDUCATIONAL CONTEXT

#### AGE

10-12

#### DURATION

1 class period / didactic hours (45 minutes) per lesson part

#### PREREQUISITES

Students should be familiar with the definition of a galaxy as collections of billions of stars.

#### MATERIALS

Laptops, projector, internet connection, WiFi  
Notebooks, pen/pencils and eraser  
Recommended to be implemented in the ICT lab

### EDUCATIONAL OBJECTIVES

The aim of the activity is to enthuse students about astronomy by introducing the use of robotic telescopes in the classroom.

#### COGNITIVE OBJECTIVES

The students,

- A. will learn about classification of galaxies as being spiral, elliptical, or irregular
- B. will navigate the LCO Archive
- C. will work as Scientists:
  - C1.generate hypothesis,
  - C2. plan and perform in teams their investigation,
  - C3.analyze the data they gathered,
  - C4.showcase in teams their results in the plenary of the classroom
  - C5. evaluate/reflect



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## AFFECTIVE OBJECTIVES

The students ,

D. attitudes towards mistakes will change while performing their investigation in the LCO Archive where images of unsuccessful observations are displayed as well as successful observations in order to learn by comparing conditions and settings of the requested observation.

E. will appreciate showcasing their results to the plenary of the classroom,

F. will appreciate the discussion/evaluation/reflection in the plenary of the classroom.

G. will be enthused by using robotic telescopes in the classroom.

## PSYCHOMOTOROBJECTIVES

The students in teams will showcase their results

## CONNECTION TO THE CURRICULA

- Curriculum of Greek Primary School 6<sup>th</sup> grade (11year olds)
- -Physics, unit: Light, chapter Light and Colors
- -Geography, unit A: Earth as a celestial body, chapter 6: Our solar system
- -ICT, creating and expressing via multimedia and presentations

## EDUCATIONAL APPROACH

Inquiry based learning

## ORIENTING & ASKING QUESTIONS

*Orienting: Provide Contact with the content and/or provoke curiosity*

*Define Goals and/or questions from current knowledge*

Do we know what a Galaxy is?

Do Galaxies look the same or different?

How do we know that?

Would you like to actually see galaxies? And study their shapes?

How about using a robotic telescope that Scientists use from a global network of 25 telescopes from 7 sites all over the world?

At this point the image of the Las Cumbres Observatory (LCO) <https://lco.global/> will be presented to the students:



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## HYPOTHESIS GENERATION AND DESIGN

*Generation of Hypotheses or Preliminary Explanations*

*Design/Model*

Do Galaxies look the same or do they have different shapes?  
If all galaxies are the same they will have the same shape.

## PLANNING AND INVESTIGATION

*Plan Investigation*

We are going to learn about shapes of Galaxies by using robotic telescopes of the [LCO network](#). At first we will navigate through the LCO portal and learn about LCO and its mission, the telescopes and the sites. Teacher will show the [LCO Archive-gallery](#) to the students where images of Galaxies are displayed. At this point students will learn about the terminology used for galaxies (M101, NGC4449) Then the students will navigate under the guidance of their teacher through the LCO Archive. The settings / toolbar and terminology e.g image name, time, object and filter will be explained. The teacher will start the investigation of images of Galaxies by filling in the field "Object" e.g. M101. The image of the Galaxy will be shown to the students. Students are asked to team up and plan their investigation having in mind our Hypothesis

Image Name	Time	Proposal	Object	Filter	Type	Exp. Time	R. level
lctm004-fs03-20230219-0242-x00	2023-02-20 08:36:46		auto_focus auto_focus rp		EXPERIMENTAL	10.0	Raw
lctm004-ak02-20230219-0237-d00	2023-02-20 08:36:43		calibrate	opaque	DARK	299.8	Raw
lctm004-ak02-20230219-0237-d91	2023-02-20 08:36:43		calibrate	opaque	DARK	299.8	BANZAI
lctm004-ak02-20230219-0405-x00	2023-02-20 08:36:43		auto_focus auto_focus air		EXPERIMENTAL	10.0	Raw
lctm004-ef01-20230219-1064-x00	2023-02-20 08:36:43		auto_focus auto_focus air		EXPERIMENTAL	10.0	Raw
lctm004-ak02-20230219-0179-d00	2023-02-20 08:36:18		calibrate	opaque	DARK	299.8	Raw
lctm004-ak02-20230219-0179-d91	2023-02-20 08:36:18		calibrate	opaque	DARK	299.8	BANZAI
lctm004-fs03-20230219-0241-x00	2023-02-20 08:36:09		auto_focus auto_focus rp		EXPERIMENTAL	10.0	Raw
lctm004-ef01-20230219-1063-x00	2023-02-20 08:36:06		auto_focus auto_focus air		EXPERIMENTAL	10.0	Raw
lctm004-ak02-20230219-0405-x00	2023-02-20 08:36:06		auto_focus auto_focus air		EXPERIMENTAL	10.0	Raw
lctm004-fs03-20230219-0240-x00	2023-02-20 08:35:26		auto_focus auto_focus rp		EXPERIMENTAL	10.0	Raw
lctm004-ef01-20230219-1062-x00	2023-02-20 08:35:26		auto_focus auto_focus air		EXPERIMENTAL	10.0	Raw

### *Perform Investigation*

The students in teams will search for Galaxies in the LCO Archive.

The teams will download the images of Galaxies that they will find in the LCO Archive in a file in their Computer in order to test their hypothesis.

## **ANALYSIS & INTERPRETATION**

### *Analysis and interpretation : Gather result from data*

After having gathered the data needed to test our hypothesis the teams will analyze and interpret the data in order to conclude if our hypothesis is true or false.

## **CONCLUSION & EVALUATION**

### *Conclude and communicate result/explanation*

The team's goal is to reach a conclusion about their findings, explain their results and communicate it to the plenary of the classroom.

It is important to highlight to all the teams to make their presentation in a certain timeframe so that there will be enough time for a class discussion.

### *Evaluation/Reflection*

After the presentation of the outcome of every team's investigation a class discussion/reflection will follow.

"Do Galaxies look the same or do they have different shapes?"

"If all galaxies are the same they will have the same shape."

Teams are to reflect upon their investigation and the outcome.

### *Consider other explanations*

Did the investigation go as planned?

Were they able to test their hypothesis with the gathered data?

Did the outcomes reach an agreement or not?

What explanations are there?



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