

LOOKING BACK FROM THE MOON AND BEYOND

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In this session, we will discuss iconic historical imagery of the Earth which has shaped our worldview. Based on these images, we will refer to the impact but also challenges of an earth-centric view from space so that teacher students will become aware of the exclusiveness of outer space imagery, especially of outer space photography. Based on the analysis of iconic imagery, we will change perspective and look back on Earth by using *Stellarium*. Furthermore, we will spot other planets (e.g. *Neptune*) of the solar system by using (robotic) telescopes (e.g. *Faulkes Telescope*) to follow an inclusive approach as we take pictures without having to go into outer space. This scenario/session should raise awareness in teacher students for the importance of using (robotic) telescopes, being active in investigating the (nightly) sky in their future classrooms to make their future students interested in the STEM area and also actions of LaSciL in general.

EDUCATIONAL CONTEXT

AGE

20-30 years old / age cannot be defined precisely, as I train future teachers and the age will be different due to the beginning of their studies.

DURATION

3-4 hours

PREREQUISITES

no special prerequisites needed

EDUCATIONAL OBJECTIVES

WHAT DO YOU AIM FOR YOUR STUDENTS TO LEARN THROUGH THIS ACTIVITY

COGNITIVE OBJECTIVES

- developing a critical perspective against heroic space imagery.
- understanding on how views of the Earth have changed the way we see the Earth then and now / understanding of how images shape our understanding of humankind and our place in the universe.
- understanding the position of the Earth within the solar system / finding out about different distances and perspectives of the different planets in the solar system.
- increase interest in the use of this topic and the use of robotic telescopes in the classroom to inspire their future students to pursue careers in the field of astronomy, physics, engineering, or computer science.



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AFFECTIVE OBJECTIVES

- learners' attitudes and feelings that are a result of the learning process.

PSYCHOMOTOR OBJECTIVES

- gain hands-on experience in the use of (robotic) telescopes.

CONNECTION TO THE CURRICULA

THE CURRICULUM THAT I AM REFERING TO, IS THE ONE OF THE UNIVERSITY COLLEGE FOR PRIMARY TEACHER STUDENTS AT THE KPH EDITH STEIN. THE "DIVERSITY AND INCLUSION COMPETENCE"-SECTION REFERS TO THE GENERAL COMPETENCES STUDENTS SHOULD GAIN. THE CONTENT IS TAUGHT IN THE MODULE "MAN AND HABITAT". SKILLS TO BE ACQUIRED IN THIS LECTURE ARE LISTED BELOW.

- **Diversity & inclusion competence:**

Based on a comprehensive understanding of inclusion, the acquisition of these competencies to all pedagogical fields of action in the sense of an intersectional and interdisciplinary synopsis. Students develop an inclusive basic attitude and are able to use the diversity of learners for learning progress. They are aware of the possibilities and limits of their actions and integrate this awareness in their professional actions.

- **Man & Habitat:**

Students are able to perceive the immediate living space in biological and technical terms. They acquire factual competence with regard to analysis and assessment as well as aesthetic and socio-political aspects of everyday culture. They can develop practical tasks on the problem area of everyday culture for their own teaching. They acquire orientation and overview knowledge for the development of political competencies and for the analysis of central problem areas in politics and society. They recognize that historical processes are processed in narratives that are subject to the subjective view of the historian - explore and discover their own textile culture and know other cultures in the areas of living, playing and dressing.

EDUCATIONAL APPROACH

Participatory learning, problem-based learning, visual and transformative learning, interdisciplinary activities



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ORIENTING & ASKING QUESTIONS

Orienting PHASE I – Quote:

„Since then, images have played a key role in our exploration of Mars and the other worlds of the Solar System and it is largely images that have shaped and defined these distant globes in our imaginations, transforming them into real places that we might one day hope to visit or even go to live.“ (Marek Kukula in: *Observations from the New Colony*)

I will start with this quote and ask students what the author could have meant by this.

Furthermore, I will ask which kind of famous images from Earth they can remember/come to their mind?

Hopefully, they will come up with images like “Blue Marble”, “Pale Blue Dot” etc. Depending on what kind of images they will come up, at least two of them are discussed in detail.

Orienting PHASE 2 – Imagery:

Four iconic images of the EARTH will be projected on the wall to have a close look at them. We use the VTS-method to look at them closely and to see what associations, feelings etc. the group has when discussing those images. The guiding questions following VTS-method are:

- (1) *What is going on in the picture?*
- (2) *What do you see that makes you say that?*
- (3) *What else do you see?*

For more information on the VTS-method follow that link <https://vtshome.org/>

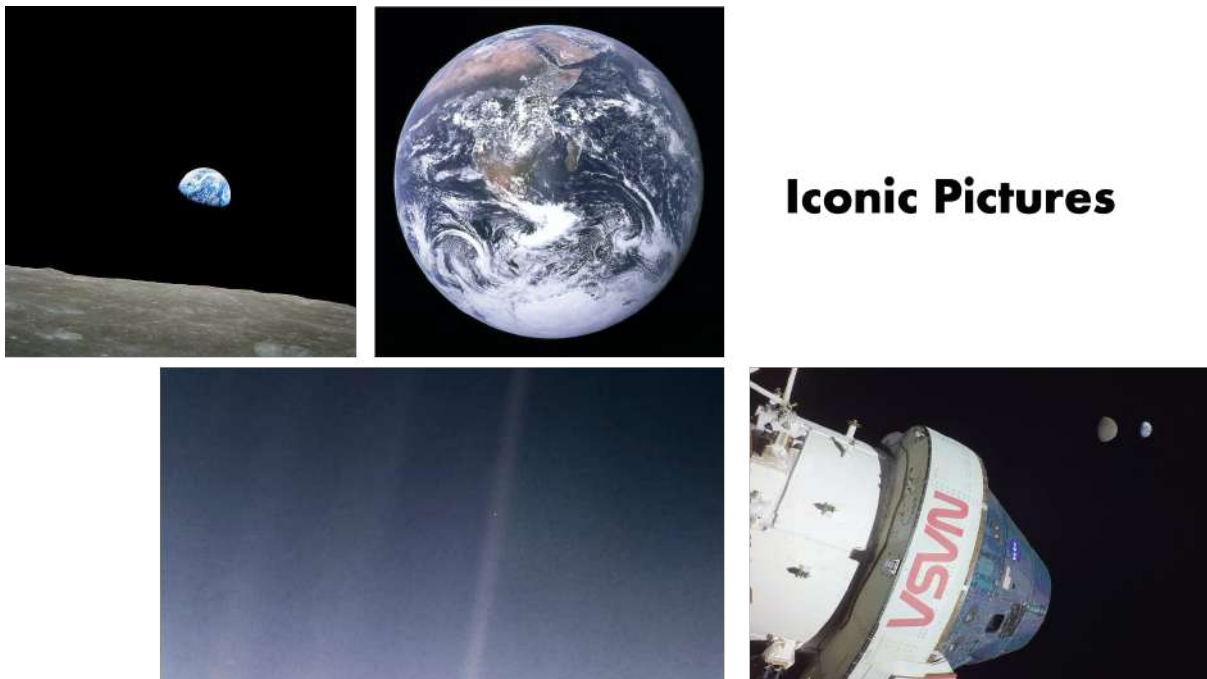


Figure 1-4: Iconic Images of the Earth (“Earthrise”, “Blue Marble”, “Pale Blue Dot”, “The Orion Image”)

Orienting PHASE 3 – Discussion and Critique:

Based on what the teacher students have found in the pictures, we will discuss the following questions on the level of impact and change that the images had on humankind.

Guiding questions are the following:

Level of **impact**: *Why were these pictures important for humankind?*

Level of **change**: *Can we find a difference on the representation level between those pictures during history?*

Level of **critique**: *Why is it so important to have pictures of the Earth for humankind? Who took the pictures/who is the author?*



Image “Earth Rise”:

December 1968 / 3 astronauts orbiting the Moon to test systems in preparation for the Apollo 11 landing

Impact:

- the most influential environmental photograph ever taken.
 - attention on how human industries were harming terrestrial ecosystems.
-



Image “Blue Marble”:

1972 astronauts took the picture during the last Apollo mission on their way to the Moon. The whole Earth was illuminated by the Sun, giving it the appearance of a glass marble. It is one of the most reproduced photographs in history.

Impact:

- emblem of the environmental movement.
 - catalyst for a holistic approach to Earth’s environment as a biosphere in delicate balance.
-



Image „The Pale Blue Dot”:

1990/farthest view of Earth comes from the Voyager 1 spacecraft.

At the request of visionary astronomer Carl Sagan, it turned its camera back on Earth for one last time at a distance of 6 billion kilometers.

Impact:

- emphasised Earth’s insignificance in the cosmos.
 - futility of human hatred, violence and war when seen in the context of the cosmos.
-

IMAGE “THE ORION IMAGE”:



NOV. 28, 2022, NASA'S ORION SPACECRAFT REACHED ITS MAXIMUM DISTANCE FROM EARTH DURING THE ARTEMIS I MISSION—268,563 MILES AWAY FROM PLANET EARTH, FARTHER THAN ANY SPACECRAFT DESIGNED TO SEND HUMANS TO SPACE AND BACK HAS GONE BEFORE. IN THIS IMAGE, ORION CAPTURES A UNIQUE VIEW OF EARTH AND THE MOON, SEEN FROM A CAMERA MOUNTED ON ONE OF THE SPACECRAFT'S SOLAR ARRAYS.

IMPACT:

- EXPANSION OF THE HUMAN SPHERE OF INFLUENCE AS THE BIGGEST OBJECT IN THE IMAGE IS A PIECE OF HUMAN TECHNOLOGY, SYMBOLIZING MASTERY OVER THE NATURAL WORLD.
 - ENTIRE EARTH–MOON SYSTEM AS A SINGLE ENTITY, WHERE BOTH HAVE SIMILAR WEIGHTING.
 - ENVIRONMENTAL ETHICS: AS SPACE TRAFFIC WILL INCREASE, HUMAN ACTIVITIES WILL HAVE MORE IMPACT ON THE LUNAR ENVIRONMENT AND BEYOND. □ RESPONSIBILITY FOR MORE THAN JUST EARTH NOW.
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HYPOTHESIS GENERATION AND DESIGN

GENERAL QUESTION: *WHERE ARE THE LIMITS OF PHOTOGRAPHY OR PICTURES TAKEN BY HUMANS (THINKING OF PHOTOGRAPHY) AND WHERE DO WE NEED TECHNICAL SUPPORT TO GENERATE PICTURES?*

Question I:

What kind of tools do we have to be able to look at Earth without having to be an astronaut (e.g. *Stellarium*, *Google Earth*) being in Outer Space?

What can be detected on Earth by using those tools accept only having an iconic image?

Question II:

What else can we find in the sky when looking from the distance/perspective where the photographs were taken (e.g. planets? solar system?)?

Question III:

Find out about the different distances from where planet Earth was shot.

Find out which of those four pictures were taken from the furthest or nearest point.

If you compare the distances of the different planets in our solar system, which planet is the furthest away and what is the distance between the Voyager 1 picture “The Pale Blue Dot” and the furthest planet in your solar system?

PLANNING AND INVESTIGATION

Answering Question I:

We use *Google Earth* to spot the different hemispheres (not only one) of the Earth. We use a view of the Earth where there are no continents visible for example. We break with a map-like-view on the Earth, where the North is pointing up (Blue Marble was cropped and the original image had the South pointing up).

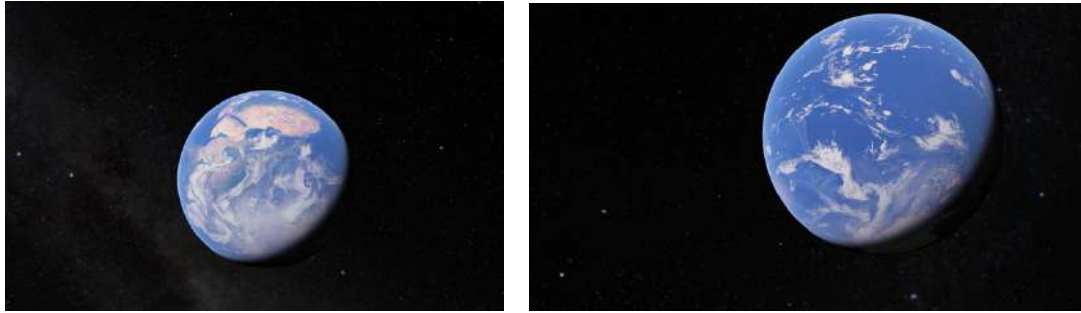


Figure 5-6: Different views on the Earth by using Google Earth

Answering Question II:

We'll launch *Stellarium* and set your location on the Moon for example (e.g. Earth Rise) and spot what we can see around us. We can set our location on any planet we wish and approach the Earth.

We can also set the time when the photos were taken to see for example what side of the Earth was visible when the picture "Earth Rise" was taken.



Figure 7: Perspective on Earth from Neptune by using Stellarium

Answering Question III:

We do research on the different distances and plan to observe the furthest planet away from Earth.

- "Blue Marble": 29.000 kilometers from the Earth
- "Earth Rise": 400.000 kilometers from the Earth
- "The Orion Image": 432.000 kilometers from the Earth
- "Pale Blue Dot": 6.000.000 kilometers from the Earth



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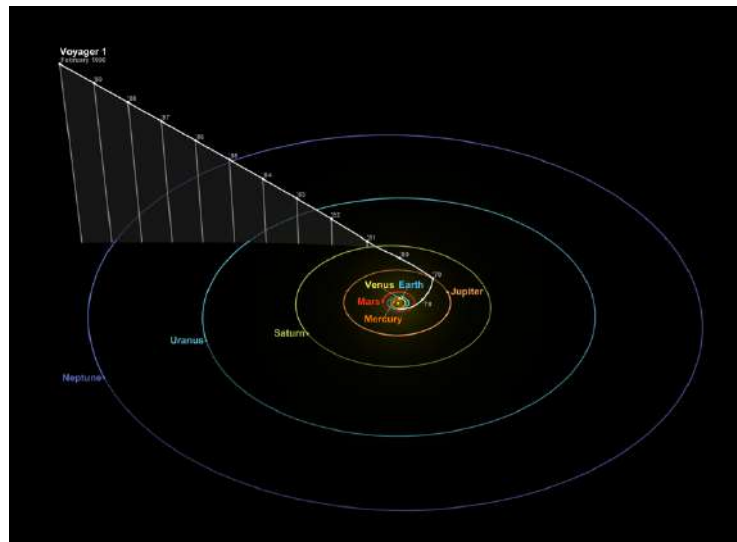


Figure 8: View of the distance where “The Pale Blue Dot” was shot

Neptune is the furthest planet in our solar system. It is about 4.687,3 million kilometers away. The Pale Blue Dot was taken further away than Neptune is located in our solar system. We will use a robotic telescope to spot the planet Neptune. We will also try to spot the moon to be able to see the details of its structure (e.g. reference to the picture “Earthrise”).

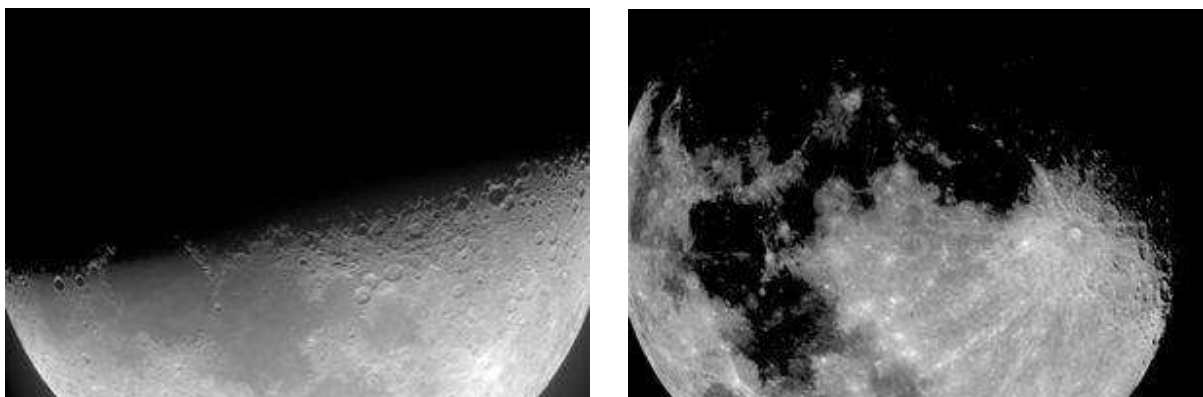


FIGURE 9-10: PICTURES OF THE MOON USING FAULKES TELESCOPE / FAULKES TELESCOPE ARCHIVE

AS NEPTUNE IS A RATHER A BRIGHT OBJECT FOR A 2M-TELESCOPE AND THE FAULKES TELESCOPE IS PRIMARILY USED FOR IMAGING GALAXIES, NEBULAE AND CLUSTERS, THERE WILL ALSO BE AN EXCURSION PLANNED IF THE WEATHER CONDITIONS WILL ALLOW. SO, WE WILL ARRANGE A TRIP TO THE “STERNWARTE VENET” WHICH IS LOCATED NEAR THE UNIVERSITY COLLEGE IN JUNE 2023 AND WHICH WILL ALLOW US TO OBSERVE THE DIFFERENT.

PROGRAMM:

18:00: ASCENT WITH THE VENET CABLE CAR

18:30-20:00: ENJOYING SUNSET WITH 360 DEGREE SUMMIT PANORAMA

21:30: GUIDED TOUR IN THE OBSERVATORY

22:30: DESCENT WITH THE VENET CABLE CAR

INFORMATION ABOUT THE TELESCOPES AT "STERNWARTE VENET":

SOLAR TELESCOPE: LUNT H-ALPHA TELESCOPE 80THA/B1800FT PRESSURE T.

TELESCOPE: MEADE #45050 ACF 406MM F8 OTA

MOUNT: 10MICRONGM3000 MOUNT - AXIS CROSS.

EYEPIECES:

TELEVUE PANOPTIC 41MM - 2" - 68° FIELD OF VIEW

TELEVUE NAGLER 31MM - 2" - 82° FIELD OF VIEW

TELEVUE ETHOS 17MM ULTRA-WIDEFIELD EYEPIECE - 2" - 100° FIELD OF VIEW

DOME:

360 DEGREES ROTATABLE, MOTORIZED

SHUTTER (DOME SLIT OPENING), MOTORIZED

DIAMETER: 5.5 M

HEIGHT: 3.8 M



FIGURE 11: PICTURES OF THE "STERNWARTE VENET"

ANALYSIS & INTERPRETATION

The students will get to know and observe the distances where the different pictures of planet Earth have been taken. They will produce/see different perspectives of the Earth themselves.

Furthermore, they will observe planet Neptune, as the furthest planet of the Solar System by using a (robotic) telescope and getting familiar with the possibilities they offer.

CONCLUSION & EVALUATION

Images taken by astronauts are a very exclusive point of view of the Earth/exclusive approach as only they could see it with their own eyes and were able to take the pictures.

Using (robotic) telescopes or technical tools support an inclusive approach when observations are taken by students themselves without being exclusively selected.