

Does the Sun actually move?



The solar apparent
motion for primary
schools

Metadata

General Info

Title

Does the Sun actually move?

Short description

In this demonstrator we study the motion that Sun seems to have across the sky (apparent) in combination with the shadows of terrestrial objects during the day. We construct a model to represent the rotation of the Earth, discuss its critical role for life and also discuss how important the scientific models are for research.

Keywords

apparent motion of the Sun, models, rotation

Educational Context

Context (Greek curriculum)

- 6th Grade of Primary School, Science, Modern Physics-Technology-Environment-Space, Solar System
- Skills Laboratory

Age: 10-11

Prerequisites: Basic knowledge about the solar system

Duration

3 hrs max

Educational Objective

Cognitive Objectives

- To represent the rotation of the Earth
- To understand what is really happening and we have daytime and night time
- To see that it took thousands of years for humanity to fully understand the celestial motions in our solar system and our position in it

Affective

- To be willing to participate in constructions of the demonstrator

Psychomotor

- To cooperate for the model construction

Subject Domain

Big Ideas of Science

The Sun appears to move across the sky, but things are not always as they appear.

The Earth rotates from West to East, making the Sun APPEAR to move from East to West.

Orienting & Asking Questions

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

Is the Earth that revolves around the Sun or the opposite?

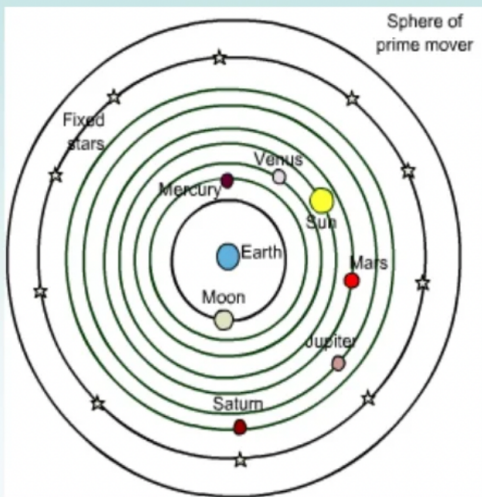
How easy you think it is to find the truth and what observational evidence you could rely on?

Let's have a quick history lesson

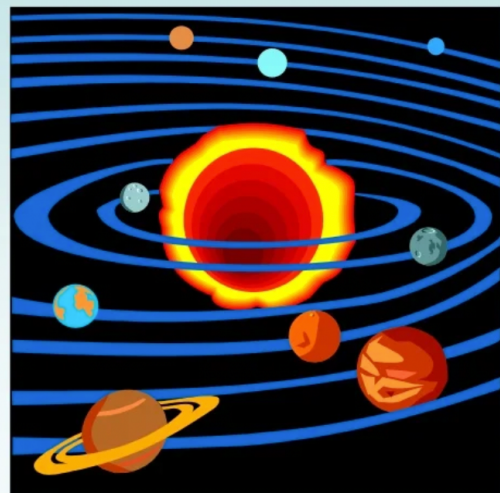
https://www.youtube.com/watch?v=ZpZ3xY5_4ng

Geocentric vs Heliocentric

- “Geo” means Earth



- “Helio” means sun



Define Goals and/or questions from current knowledge

Is there any other star in our solar system?

From which spot of the horizon the Sun rises?

Have you ever seen the Sun to rise from a different spot of the horizon?

Hypothesis Generation and Design

Generation of Hypotheses or Preliminary Explanations

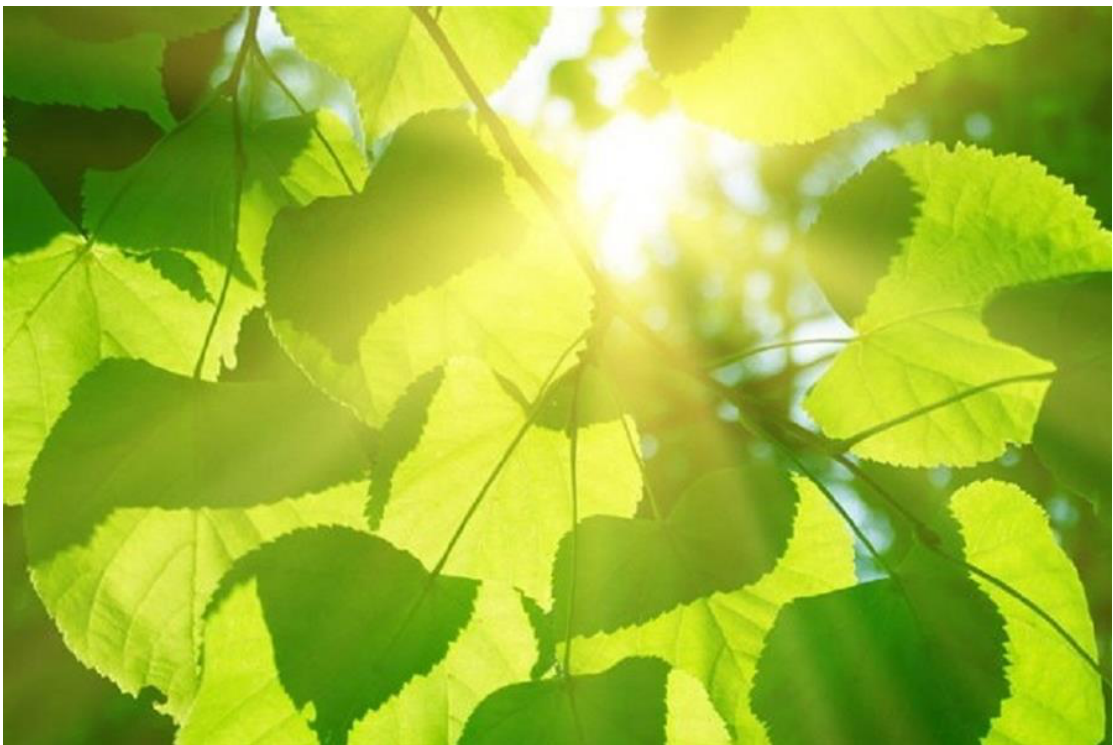
The motion the Sun seems to make, during the day, is responsible for which phenomenon? Think about where the Sun is on the sky, when we fall asleep at night.



Credit: ASTROEDU

Is this motion across the sky a real motion in our solar system?

Could we live without the Sun and its motion?



Does the motion of the Sun play a role in life on Earth?

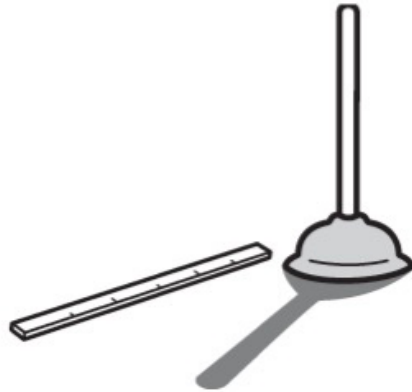
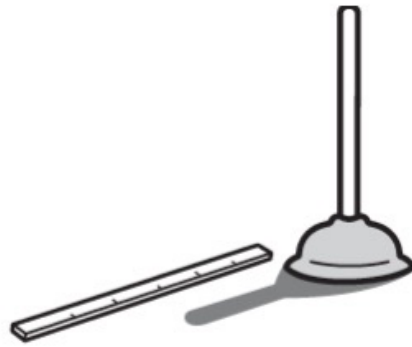
Design/Model

When we travel by train, we observe the objects outside of it. It seems that all of them make a motion backwards which is opposite of the train's motion. So the motion we observe is related to our own motion as observers.

Planning and Investigation

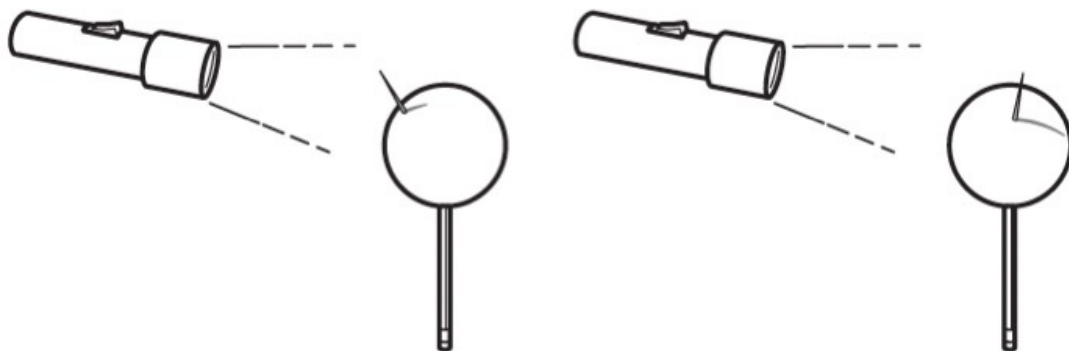
Plan Investigation

We'll use an outdoor area on a sunny day, a sheet of paper, a ruler and an object that casts a narrow shadow, like this which is in the next picture.



We'll also construct a model of the Sun and Earth as the following one, on the second picture.

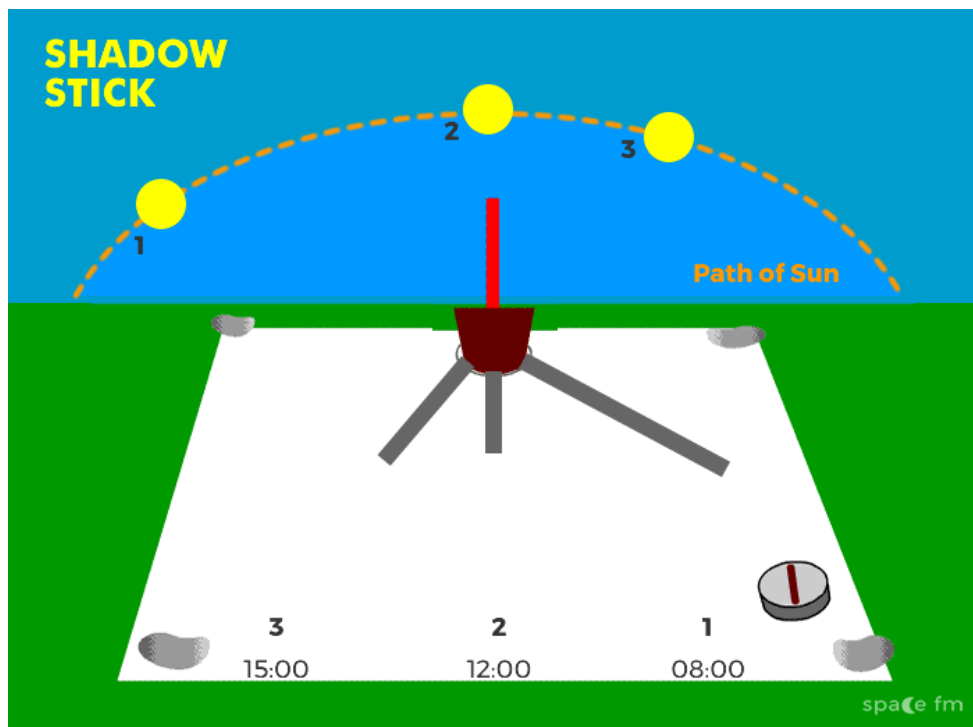
For this construction, we'll need one Styrofoam or a clay ball, one push pin or a straight pin, one flashlight or a lamp or whatever it plays the role of a light source and a stick or pencil to use as a handle for the ball. A light source which emits light in all directions, is ideal for the simulation!



Perform Investigation

Firstly, you set up the experiment outside. Put the narrow object in a spot that everyone can see its shadow and leave it there for about three hours (you can also extend the experiment to several hours, as it seems to next picture, if you want) and the ruler will be used for the measurement of the shadow's length during the day.

Can you find where is the Sun without looking at it directly and how do you know it?



Credit: space.fm

Measure the shadow's length every hour. What do you observe? What time of the day is the shadow's length shorter? At 9 o'clock or at noon? On what this observation depends?

Subsequently, the following activity will be indoor and you have to

darken the room for it. You can use the same narrow object and the flashlight in order to perform inside what you observed outside.

So you can see the motion that the Sun seems to make during the day and it's called apparent motion. Does the Sun really move across the sky? Is there another explanation for the pattern we have observed?

Now it's good to be separated in groups of 3 or 4 students in order to cooperate for the construction and to make the last part of your experiment.

Place the pins into the balls, insert a stick or pencil for a handle, and then use the light source to create a model that shows how sunlight moves across the Earth. Keep in mind what we've just observed with the shadow of the narrow object.

Can you move the ball relative to the light source so that the shadow of the pin moves the same way the shadow on the playground moved (apparent motion of the light source, not actual motion), like it seems on the second picture above? Keep the light source motionless.

Analysis & Interpretation

What kind of motion should we follow with the ball we hold to visually achieve the same result as observing outdoors when the Sun was the source of light?

A very good educational video about the relative motion between the Earth and the Sun, is the following:

<https://www.youtube.com/watch?v=l64YwNlwro>

Conclusion & Evaluation

Conclude and communicate result/explanation

What you construct at the last part of the demonstrator is called model. It's a technique that scientists use to study things they can't get to and study directly, like the Sun. Models allow you to make predictions that you can then test by observation. In this model, the flashlight (or the lamp ideally) represented the Sun and you could move it about to imitate some things that the Sun does.

What did you learn about the apparent motion of the Sun across the sky?

Further videos, which are suitable for this demonstrator, are the following:

“How the Sun affects the Earth”

https://www.youtube.com/watch?v=i_jiQzoQF5M

And “Why the world doesn't revolve around you”

<https://www.youtube.com/watch?v=RsKdoEtZdd8>

Evaluation/Reflection

About the importance of this project for you, rate from 1 (lowest) to 5 (highest) each topic:

- The interest that this activity provoked to you
- The desire to talk about it to your classmates
- The knowledge acquired/reinforced
- It seems like a game to you