Mysteries of Motion

Eugenia Etkina

Please rename yourself

First name

Subject matter that you teach

Example: Eugenia Physics

Waltraud Mathematics

Wolfgang Physics

Franz Mathematics Physics ComputerScience

Marion technology and design

Remember, what we start with when we want our students to develop a new concept? - the need to know

Watch the video and reflect on how you felt at the end.

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

Use your telescope and observe Eugenia

What does it mean to “move”?

Testing if the motion is relative to the observer

Imagine that you are sitting on a battery operated car moving at constant speed up a ramp. You fix a camera on this car. When you car is up on the ramp, another cart with no battery is pushed up the ramp. What will you see being on the floor? What will your camera record?

Make your predictions and explain how you made them. In order to make the prediction you first need to imagine what happens to a rolling object pushed up a ramp?

Team 1

Elisabeth, Pia and Marion:

From the GoPRo Perspective the other car seems going back down when the same velocity is reached

From sitting on the floor both move upwards, but the blue one slows down while moving up until it stops and goes really down

Team 2

GoPro-Cam: The second car approaches and than moves away

Floor-Cam: Both objects move up, one with constant speed, the other one with decreasing speed (and finally moves back downwards with increasing speed)

Let’s compare the outcome to your prediction

https://youtu.be/7lNParoajuA

Applying the idea

Describe what you see in the video (pay attention to details) and explain how it happened.

https://www.youtube.com/watch?v=kTgN5cU580k

How important is it to understand that motion is relative?

Watch this video but turn off your sound. Pay attention to the Moon at the beginning.

https://www.youtube.com/watch?v=Ys1w9A4DrO4

How can we explain the motion of the Sun and the Moon?

Use your styrofoam balls and the flashlight to model the process. Try to devise different models, not just one.

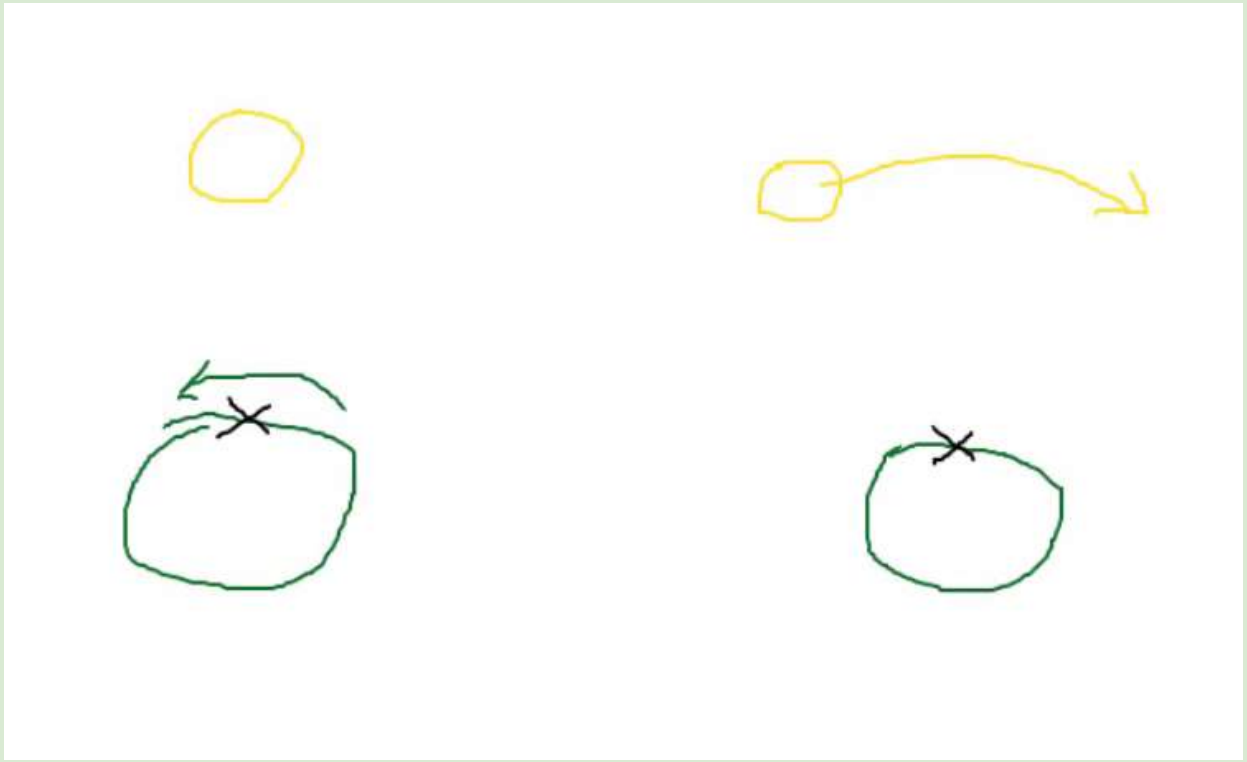
Team 1

Model 1: keep the ball in place, the mark shows in direction to the flashlight. Then the flashlight ist moves around the ball and we see the light spot on the ball separating from the mark on the ball.

Model 2: the flashlight keeps in place and the ball is turning around itself. The mark and the light spot on the ball separate in the same way.

So we can´t distinguish which of the two is moving.

Team 2

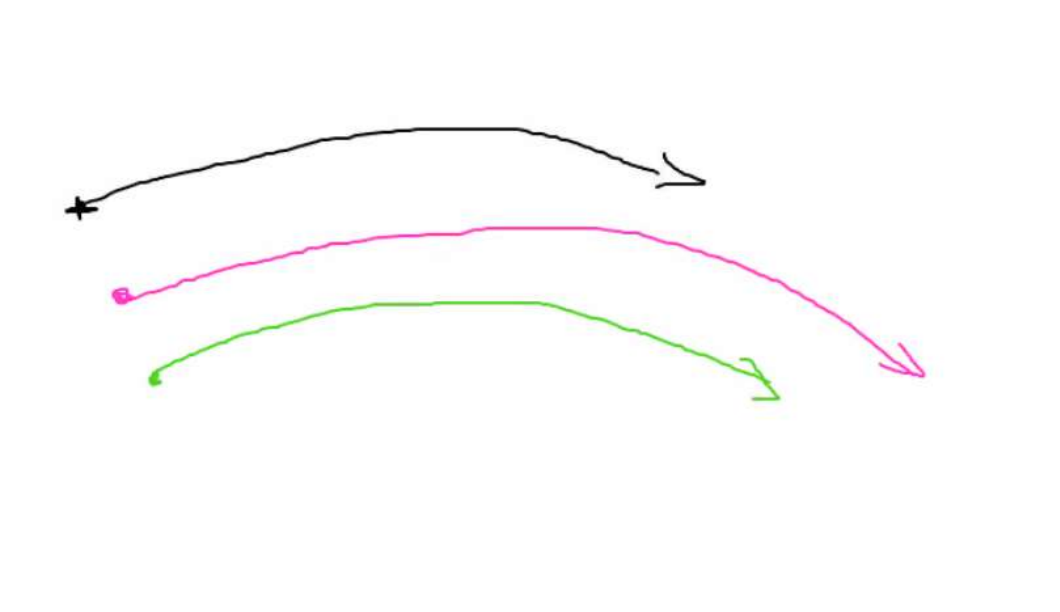


Testing experiments

Use both models to predict how we will see the motion of stars on the night sky if you we could observe them for a long time taking pictures every 3 seconds and then making a movie out of all these photos. Make sure you provide as much detail as possible in your prediction.

Team 1

Team 2



Testing experiments

Observe the outcome of this experiment. Did it match your prediction? Does it help you to differentiate between the two models?

https://www.youtube.com/watch?v=tp6UkqIwVfk

This means that we don’t know which object moves - the sky with the Sun and stars around Earth, or Earth rotates around its axis. Why is it so difficult to figure out?

https://mediaplayer.pearsoncmg.com/assets/_frames.true/sci-OALG-6-4-6a

How do we know whether the sky rotates around Earth or Earth rotates on its axis?

Jean Bernard Léon Foucault (1819 - 1868)

born and died in Paris.

https://youtu.be/BO9HCBzJDjg

Back to the “Need to Know”

How can we explain our reaction to the video?

What did you learn today that will be useful in this project?

Other people also failed in their expectations of the first video

Building models with stuff that we have around and observations

Try if they hold, when used to explain different phenomena

Represent the models in many ways

Design mental models of what we observe.

Design testing experiments to decide what explanations work.

When doing testing experiments, make a prediction based on your model first!

Present your predictions.

Trigger curiosity.

Everybody should design or build its own modell

Everything depends on the point of view