

## Retrograde Motion Activity

### Astronomy

### Lesson 3

For this activity, students will pretend to be the Sun, Earth, Mars and the background stars in order to experience the phenomena of retrograde motion. Students should have already read the NASA article about Mars' retrograde motion, so, in theory, they should be familiar with the reasoning behind the behavior.

#### **Part A: Earth's orbit**

Have students stand in a large circle, preferably outdoors, with at least a 40-foot diameter.

*Today we're going to do an activity to understand how the planets appear to wander among the stars. Does anyone remember what that "wandering" behavior is called? (Retrograde Motion) In order to truly experience retrograde motion, we're going to pretend to be different objects in our solar system so that we can see and understand the reason behind this apparently erratic behavior. We need two volunteers, one to be the Sun in the center of our solar system, and one to be the Earth moving around the sun.*

The Sun should stand in the very center of your circle and the Earth should stand a few feet away.

*Everyone on the circumference of our circle is a star in another galaxy.*

(Optional: the stars can take on the names of different constellations and contort themselves into a representative shape of their constellation.)

*Now, it's time to get a move-on! How should our Earth move in order to represent a single day? (Turn in place one time—a single rotation) And how should our Earth move in order to represent a year? (Turn in place while also moving around the Sun—rotating and revolving)*

#### **Part B: Retrograde Motion**

*So, that's how the Earth moves, but what about retrograde motion? Based on what you read, what else do we need in order to fully understand retrograde motion? (We need a Mars, or other outer planet) Can we have a volunteer to be Mars?*

*Where should Mars be positioned in relation to the rest of our solar system? (Between Earth and the stars)*

*How should Mars move? Does it have a longer year or shorter year than Earth? (Mars should move more slowly than Earth around the Sun)*

Have Earth and Mars move around the Sun in their relative orbits. Earth may need to stop rotating in order to see the retrograde motion of Mars. The Sun may need to turn in place as Earth and Mars orbit in order to see the retrograde motion as well.

*What did you notice? Why does Mars appear to move backward in the sky?*

Students should notice that as Earth overtakes Mars, Mars appears to move backward relative to the background stars. Also, because the planets are moving in their own orbits, the direction an Earth observer must look to see another planet is always changing.

You may want to have other students switch out to be Earth and Mars in order to get a better sense of the apparent motion that's happening. If you have a large class, you may also want to split the class into smaller groups.

### **Extension:**

It may be helpful to have students view the Mars retrograde motion video again

(This is a movie of the apparent retrograde motion of Mars:

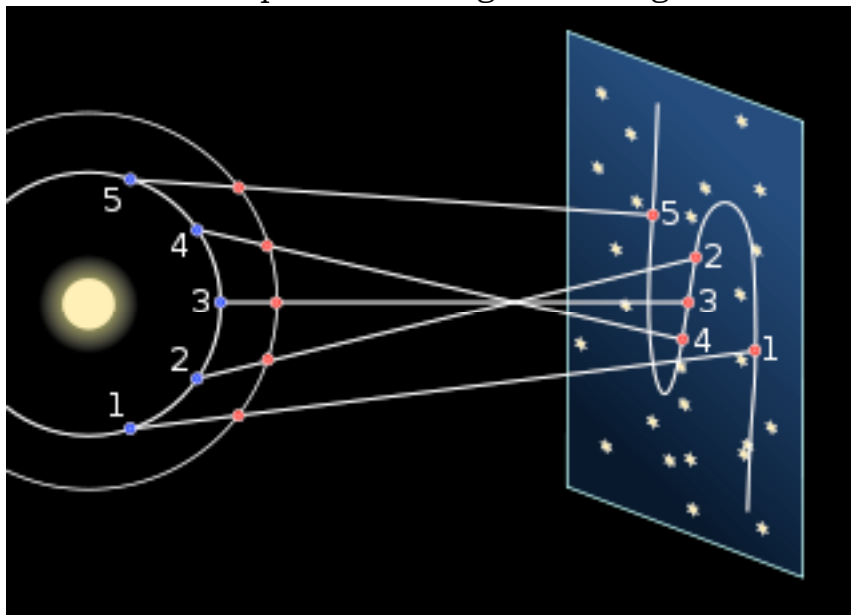
<http://mars.jpl.nasa.gov/allabout/nightsky/nightsky04-2003animation.html>.

Because it is provided by NASA, it remains in the public domain.)

(This is another motion video available from Wikimedia Commons:

[http://upload.wikimedia.org/wikipedia/commons/7/70/Apparent\\_retrograde\\_motion\\_of\\_Mars\\_in\\_2003.gif](http://upload.wikimedia.org/wikipedia/commons/7/70/Apparent_retrograde_motion_of_Mars_in_2003.gif) License: CC-BY-SA)

Or view some explanation images of retrograde motion:



The motions that produce retrograde motion. As Earth passes a superior planet, such as Mars, the superior planet will temporarily appear to reverse its motion across the sky.

Source:

[http://upload.wikimedia.org/wikipedia/commons/6/6a/Retrograde\\_Motion.bjb.svg](http://upload.wikimedia.org/wikipedia/commons/6/6a/Retrograde_Motion.bjb.svg)

Wikimedia Commons  
License: CC-BY-SA