RAFT IDEAS

Topics: Solar System, Modeling, Radial Math, Heliocentric Longitude

Materials List

- ✓ Bulk CD container base/post and cover
- ✓ String or colored yarn (non-stretchy)
- ✓ Opt.: Sticky dots, large
- ✓ Circular counter clockwise degree calibrated dial, (pg. 2)
- ✓ Chart of planet positions (heliocentric longitudes), see Website Resources for possible sources

This activity can be used to teach:

Common Core Mathematics:

- Measurement and units (Measurement and Data, Grade 4, 1; Grade 5, 1)
- Ratios & Proportions (Ratios/Prop. Rel., Grade 6, 1-3; Grade 7, 2)
- Problem Solving and Reasoning (Math Practices Grades 3-12)

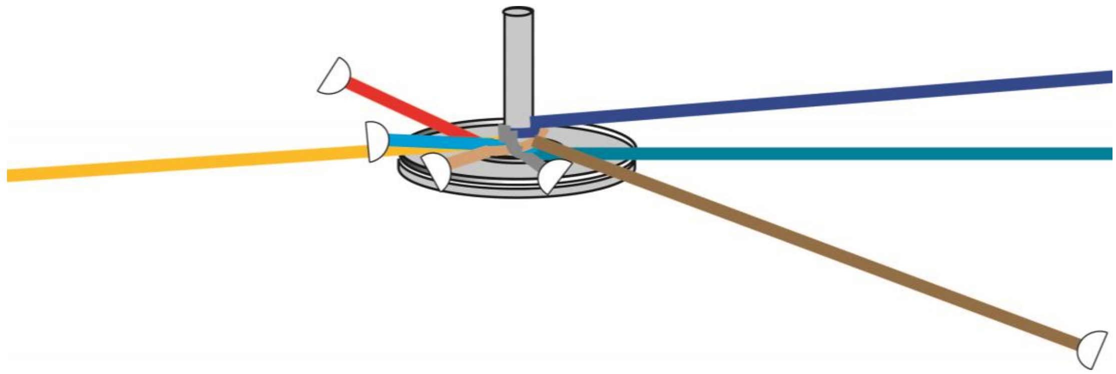
Next Generation Science:

- Seasonal night sky (Grade 5, Earth and Space Science 1-2)
- Solar system: Scale of objects & orbits (Earth & Space Science, Middle School, 1-3; High School, 1-4)
- Gravity & solar system (Middle School, Physical Science 2-4; Earth & Space Science 1-2)

raft resource area for teaching
www.raft.net

Solar System in the Round

A Radial Model of our Solar System



Students often develop the misconception that the planets are located in a line because many images depict the planets in a line extending from the sun. This model allows students to see that planets can be any direction from the Sun and track changes in the planets' positions over time.

Assembly

1. Represent the sun's position with a bulk CD container base and post. After completing the activity, place the cover over the base for easy storage.
2. For each planet, tie a loop in the end of a piece of yarn or string to fit over the central post. Then using the table below, cut a length to represent the distance between that planet and the sun. A useful size is to have the Earth to Sun distance (1 AU) = 10 cm. Other model sizes can be constructed by maintaining the correct proportions of the distances. Optional: Fold a large sticky dot over the end of the string that does not have the loop - label the dot with the name of the planet.

Model	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
E/S=10	4	7	10	15	50	100	190	300

3. Cut out a copy of the circular counter-clockwise dial (see page 2) and punch a hole in the center. Place the dial over the central post of the base.
4. Start with longest piece of yarn (Neptune) and place its loop over the central post (Sun). Use the chart of planet locations (see web resources) to align the string to the correct location for a chosen date (e.g., the first of the current month). If needed, turn the dial so that the correct direction (heliocentric longitude) for that planet is in a convenient direction.
5. Place successively shorter pieces of yarn in the **correct directions**, using the circular dial, but DO NOT MOVE THE DIAL after the first setting.

To Do and Notice

1. Continuing through the calendar, move the yarn to indicate the planet locations, month by month. Notice which planets change location quickly and which planets seem to be hardly moving at all. What causes the difference?
2. Note how the planets appear to move from the point of view of an observer on the Earth. What would observers on other planets see?
3. Plot the planet locations over the course of several years, noting the location periodically (e.g., once a year, once a quarter.) What patterns become apparent?

Created and written by Tom Gates (RAFT)

The Science Behind the Activity

Our Solar System contains one star (the Sun), 8 planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune), 10's of satellites (moons) that orbit the planets, dwarf planets (e.g., Pluto, Ceres, and Eris), 1000's of asteroids that orbit the Sun, and at least millions of comets.

The orbits of the planets are nearly circular ellipses with the Sun at one focus of the ellipse. Their orbits lie near the plane of Earth's orbit, known as the ecliptic. The planets all orbit in the same direction (counter-clockwise looking down from above the Sun's north pole). The closer an object is to the Sun, the faster it completes an orbit. Many comets, asteroids and Kuiper belt objects (icy bodies in a region past the orbit of Neptune) follow highly-elliptical orbits which are usually inclined at a greater angle to the ecliptic than those of the planets.

Web Resources (Visit www.raft.net/raft-idea?isid=392 for more resources!)

- Planet heliocentric longitudes (solar ecliptic): https://omniweb.gsfc.nasa.gov/coho/helios/planet.html