The Solar System is REALLY BIG: a properly scaled model of the solar system
Grade 5

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References:

- www.lpi.usra.edu/education/explore/solar_system/planet_distances.
- Conversion Table

Benchmarks & Objectives:

ES-2: Explain that Earth is one of several planets to orbit the sun, and that the moon orbits earth.

Materials:

- Assorted spherical objects to represent the other planets
- Notecards

Initial Demonstration:

Hold up a model of the Solar System found in a science book. Talk about the different planets, and their relative sizes and characteristics. Explain that in order to fit this model onto one page of paper, they had to shrink the distances. We are going to find out the actual distances between planets.

Target Observations:

- The Solar System is very large. The distances involved are huge.
- The planets are very small in relation to the size of the sun.
- Pluto doesn't look or behave like the other planets.

Target Concept:

- The pictures we see of the solar system are models and do not represent actual distances.
- There are four inner planets that are small and rocky, and there are four outer planets that are gas giants.
- Pluto, which used to be a planet, is now a 'dwarf planet' or a slow moving comet.

Procedure:

Break the students up into groups. Assign each group a planet. On a note card give each group the diameter of their scaled planet. This is a good opportunity to review what 'diameter' means. Tell the group that they have to find something that represents their planet's size, relative to the size of my sun. Demonstrate with the sun: "I will use a softball. It has the correct diameter, and it is the correct shape." Most planets are very small, so have them tape their object to the back of the note card so they don't lose it.

Once all students have their objects, take the students outside and place a softball on the ground. Explain that this represents the sun. Then hold up the planet Mercury. Compare

the two relative sizes. Ask “How far away do Mercury should be placed from the sun?” Pace off the distance and set it down. Do this for the rest of the planets to show how far apart things really are! Give them a grasp of the larger distances by telling them how long it would take to get there in a plane or a space ship. Compare the size of the planets whenever possible. When you start getting far away, stress that when a star is very far away, it just looks like a point of light. What do we call a point of light? (star) Thus stars are just suns that are very far away.

The spaces are very far, and chances are you will not get all the way out to Pluto, but hopefully they will get the point by then. You can stress that Pluto does not behave like the other planets. It is small and hard, like the inner planets, but it is very far away. It has a very eccentric orbit. It is mainly made of ice. Recently Pluto has be relegated to ‘dwarf planet’ status. You can then ask, if we shrink our universe to this size, how far would we have to walk to get to the next star (Alpha Centauri). We would have to walk to Hawaii!

Discussion/Summary:

If there is time remaining at the end, have the students open their notebooks and write one paragraph with the prompt: “Why is the picture of our solar system in our science book misleading?” This may also make a good homework. You could also ask the open question, “Do you think that Pluto should be a planet?”

Object	Relative Planet Diameter (cm)	Equivilent Object	Average Distance from Sun (km)	Time to get there from Earth (plane = 300 m/s, spaceship = 28,000 km/hr*)	Relative distance from sun (meters)	Relative distance from previous planet (paces, 1 pace = 1 yard)
Sun	13.9	Softball	NA	15.8 years in plane 222 days in spaceship	NA	NA
Mercury	0.05	pencil dot	57,909,000	9.7 years in plane 136 days in spaceship	5.8	6.3
Venus	0.12	sand grain	108,200,000	4.4 years in plane 62 days in a spaceship	10.8	5.5
Earth	0.13	sand grain	149,600,000	NA	15	4.6
Moon	0.07	pencil dot	384,400 (from Earth)	14.8 days in plane	(3.8 mm from Earth)	NA
Mars	1.43	pencil dot	227,940,000	8.3 years in plane 116 days in spaceship	22.8	8.5
Jupiter	1.2	marble	778,400,000	66.4 years in plane 2.6 years in spaceship	77.8	60
Saturn	1.2	marble	1,423,600,000	134.6 years in plane 5.2 years in spaceship	142.4	71
Uranus	0.51	peppercorn	2,867,000,000	287 years in plane 11 years in spaceship	286.7	158
Neptune	0.49	peppercorn	4,488,400,000	458 years in plane 18 years in a spaceship	448.9	177
Pluto (dwarf planet)	0.02	pencil dot	5,909,600,000	608 years in plane 23 years in spaceship	591	156