

## LEADER INSTRUCTIONS

# TOILET PAPER SOLAR SYSTEM

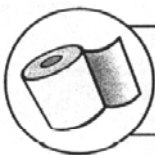
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Based on an idea by the late Gerald Mallon, a planetarium educator who spent his life helping students understand the Universe.



### A Family ASTRO Activity from the Astronomical Society of the Pacific

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**Recommended for Ages:** 8 and up

**Time to do:** 20 minutes

**Type of Activity:** Facilitated

**Number of People:** 1-4 per model

**Set-up Time:** 3 minutes

### WHAT'S THIS ABOUT?

Even in our own “cosmic neighborhood,” distances in space are so vast that they are difficult to imagine. In this activity, participants will build a scale model of the distances in the solar system using a roll of toilet paper. This is a great follow-up to the “Worlds in Comparison” activity, where families get a sense of the relative *sizes* of the planets.

### MATERIALS INCLUDED

- Table of distances to give to participants (Two to choose from. The longer [200 sheets] requires 85 ft., the shorter [100 sheets] requires 42 ft. of space).

### MATERIALS YOU'LL NEED TO GET

- One roll of toilet paper, 201 sheets or more, per family.
- Felt-tip marker(s) or gel pen, preferably 10 colors; but one pen per family will do.
- Clear tape for repairs

### SETTING UP THE ACTIVITY

- Select either the 200 or 100 sheet model and photocopy the handout.
- Pass out pens, table of distances, tape dispenser and roll of toilet paper to each family team.

### SUGGESTIONS FOR INTRODUCING THE ACTIVITY

This activity appeals to children's love of bathroom humor, but keeps it clean. Representing both the sizes of the planets and the distances between them with the same model is very difficult unless you have 1000 yards to work with. This model only shows the relative distances between the planets and still requires approximately 85 feet to complete (in the longer scale on the next page).

If you have just completed the Worlds in Comparison activity before starting this one, note that at the scale used here, Jupiter would be the size of a grain of salt. You will want to mention to the families that the scales on the two activities are different. You can also remind the families that planetary orbits are ellipses, so the numbers here represent the average distance from Sun. Also, the planets will never all be in a straight line going out from Sun, as they are represented in this model.

## DOING THE ACTIVITY

Take one sheet of toilet paper as a test sheet for the pens. Make sure the ink is not too wet, that the pens don't easily tear the paper. Also, have families practice writing on the delicate paper with one test sheet. After they have learned the best way to write on toilet paper, throw away the test sheet.

Suggest they make a dot on the seam between the first two sheets of toilet paper. This is the Sun. Write the word Sun beside the dot.

Then they can use the table of numbers provided to mark off the distances to each of the planets. The number in the table is the number of sheets of toilet paper needed to reach the orbit of each planet. It is important to tell participants that the counts in the table are starting from the Sun, not from the previous planet. (Thus, after get to Mercury, you need 1.7 more sheets to get to Venus.) They should make a dot and write the appropriate planet name on the toilet paper at the distance indicated. Ceres, the largest asteroid, is used to represent the asteroid belt.

If you don't have the time or space to complete the model, try to get to Jupiter and note that Saturn nearly doubles the distance. The same is true of going from Saturn to Uranus. Or, try using the short version of the scale in the third column below (Note that we have included two family handouts, one for each version).

Toss the toilet paper in recycling to clean up.

## FAMILY CHALLENGE

Astronomers believe there is a vast cloud of frozen comets called the Oort Cloud that surrounds our solar system. It lies roughly 50,000 times farther from the Sun than the Earth is. Ask families how many squares of toilet paper you would need to put the cloud on the longer scale model? (Answer:  $50,000 \times 5.1 = 255,000$  squares)

## BACKGROUND

**Pen Tips:** If pens are very liquid they may bleed through too much or tear the paper. Gel pens work well.

**Toilet Paper Tips:** Cheap, flat toilet paper generally works best. Textured paper is okay; printed paper can be distracting.

PLANET	DISTANCE FROM SUN (KM)	SQUARES OF TOILET PAPER OUT TO PLANET'S ORBIT (short version)	SQUARES OF TOILET PAPER OUT TO PLANET'S ORBIT (long version)
Mercury	57,910,000 km	1.0	2.0
Venus	108,200,000 km	1.8	3.7
Earth	149,600,000 km	2.5	5.1
Mars	227,940,000 km	3.8	7.7
Ceres	414,436,363 km	7.0	14.0
Jupiter	778,330,000 km	13.2	26.4
Saturn	1,429,400,000 km	24.2	48.4
Uranus	2,870,990,000 km	48.6	97.3
Neptune	4,504,000,000 km	76.3	152.5
Pluto	5,913,520,000 km	100.0	200.0