

Solar System in Your Pocket

Activity D5

Grade Level: 3–12



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What’s This Activity About?

This brief but powerful activity gives students and audiences a quick scale model of the distances in the solar system and really surprises most of those who try it about the relative location of the planets.

What Will Students Do?

They will fold a 1-meter long piece of cash register tape a number of times. The places where the folds occur (and where participants put stickers) are the locations of the planets.

Tips and Suggestions

- It’s good to have extra pieces of cash register tape and extra stickers on hand.
- This brief activity is a good lead-in to the more detailed activities in this section of *The Universe at Your Fingertips*.
- This is one of the best introductory activities to do with audiences in informal or nature settings.

What Will Students Learn?

Concepts

- Arrangement of the solar system
- Relative distances of the planets

Inquiry Skills

- Describing
- Modeling
- Ordering
- Comparing
- Measuring

Big Ideas

- Scale
- Models and simulations
- Systems



ASTRONOMY from the GROUND UP

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Solar System in Your Pocket **Activity Guide**

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Type of Activity:	Quick demo / make-and-take
Set up Time:	5 minutes to pre-cut register tape
Time to Do:	10 minutes
Audience age:	8 years and older
Group size:	any number

What's This Activity About?

You will build a quick model of the solar system by folding a piece of register tape. The relative distances between the orbits of the planets will be illustrated. Images in textbooks often depict the planets squeezed together, but this model shows how far apart they are, especially beyond Mars. This is a quick activity that can be done as a transition in a longer program or as a demonstration to entertain people waiting in a line. It's especially useful if planets are visible.

Materials

For each model:

- 1 meter length of cash register tape
- 10 round stickers: five large and five small
- pencil or marker

Setting Up the Activity

If you are doing this activity with a large group, you can **pre-cut 1 m strips of register tape** and **divide out groups of stickers** for each participant. If you wish, **practice** the steps a few times so you don't have to refer to your notes.

Suggestions for Introducing the Activity

For any of these scale model activities, it is useful to start by exploring the notion of models. Referring to playthings, such as dolls or toy cars, can be a useful reference for talking about scale models. For a more thorough exploration of this concept with ideas of how to introduce and discuss it, see the introduction to the Saturn Project.

Pull out a folded, completed sample of the model from your pocket. Point out that the planets never appear in a straight line like this in order out from the Sun, but this is just a reminder of the radius of the orbits. The planets would be found somewhere along a circle this far from the Sun. If you have a board with a thumbtack, you can tack it to the board at the Sun and show or draw out the orbits.

Doing the Activity

Now have the participants create their own Pocket Solar System models. Lead them through the following steps:

1. Place a sticker on each end of the tape, one large and one small, right at the edge. Label the large one Sun and the small one Pluto. Even though Pluto has been reclassified as a dwarf planet it serves as a useful reference point here. We can use it as the first example of such a dwarf planet ever found, just as we'll use Ceres to represent the asteroid belt later on.
2. Fold the tape in half, crease it, unfold and lay flat. Place a large sticker at the halfway point. You can ask for guesses as to which of the planets might be at this halfway point. Label the sticker Uranus.
3. Fold the tape back in half, then in half again. If there are mixed ages, give those with some knowledge of fractions the opportunity to show off by asking "What is half of a half?" Unfold and lay flat. Place large stickers at the quarter mark and 3/4 marks and label as Saturn (closer to the Sun) and Neptune (closer to Pluto).
4. Fold back into quarters, then in half one more time. This will give you eighths. Unfold and lay flat again. Place a large sticker for Jupiter at the 1/8 mark (between the Sun and Saturn), and label.
5. No need to fold the whole thing up again. If you take a look, you've got the 4 gas giants and Pluto all on there in the outer solar system. For the remaining terrestrial planets, you'll only need 1/2 of the first 1/8th! That's the inner 1/16th of your meter. Fold the Sun out to meet Jupiter to mark the 1/16th spot. A planet does not go here, but you should label this Ceres to represent the Asteroid Belt.

6. At this point, things start getting a little crowded and folding is tough to get precise distances, so fold the remaining 1/16th in half and crease at the 1/32nd spot. Place a small sticker for the Earth just inside this fold (between the Sun and Ceres) and a small sticker for Mars just outside the fold (closer to Ceres and the Asteroid Belt) and label them.
7. Place small stickers for Mercury and then Venus, between the Earth and Sun, pretty much dividing the space into thirds and label them as Mercury closest to the Sun and Venus closest to the Earth.

Wrap-up

At the end of the discussion, be sure to have everyone put their names on their tapes and fold them up to put it in their pockets. But before you put them away, here are some questions you might ask to get participants thinking about insights they can get from building this model.

1. Are there any surprises? Look how empty the outer solar system is: there is a reason they call it space! And how crowded the inner solar system is (relatively speaking).
2. Do you know anything about the physical properties of the ones that are spread out versus the ones that are crowded in close to the Sun? All the inner ones are small and rocky and the outer ones are gassy giants (except small, icy Pluto).
3. Given this spacing, why do you think little, rocky Venus can outshine giant Jupiter in the night sky? Both are covered with highly reflective clouds, and although it is much smaller, Venus is also much, much closer.
4. Does anyone know where the Eris, the largest dwarf planet would go on this model? At 97 A.U., it would more than double the size of the model. Pluto is on average 40 A.U. [A.U. stands for Astronomical Unit, roughly the mean distance from the Earth to the Sun. 1 AU = 149,597,870.691 kilometers, or about 93 million miles.]
5. On this scale (1 m = 40 A.U.) where would the nearest star be? After some guesses you could bring out your pocket calculator to use in getting how far away the star would be. This allows you to talk about how far is a light year and do the calculations to find that the next nearest star is about 7 km (4.2 miles) away. They could then take out a local map to see what is that far away from where the presentation is happening.

[Calculations: A light year, the distance light travels in one year, is about 63,240 A.U. (about 9,460,000,000,000 km). The nearest star is Proxima Centauri (visible from the Southern Hemisphere), at 4.2 light years. So, $4.2 \text{ l.y.} \times 63,240 \text{ A.U./l.y.} \times 1 \text{ m}/40 \text{ A.U.} = 6640.2 \text{ m} = \text{about } 7 \text{ km.}]$

Complementary Activities:

- Worlds in Comparison (scale model of the sizes of the planets)
- Earth as a Peppercorn (scale model of the sizes and distance of the planets)