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How Big is Our Solar System?
Build Yourself a Model

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Some time ago, I thought it would be nice to build a scale model of the solar system in my backyard as a neighborhood attraction. This seemed like a really neat idea. But, it soon became clear that this would be more difficult than I first thought. Backyards are not usually large like one might find on a Kansas farm, but even by suburban standards one might seek to represent our extended solar neighborhood in the back yard. To illustrate the problem, consider how one might proceed to build a 100 foot model on one's own property.

It should be simple enough to plant a simple stick in the ground to hold each planet. One could use tennis balls or rubber balls, mounted on the sticks and painted creatively of course, to represent the sun and each of the 9 planets. Refer to Galloway (2007) to see that I still believe in Pluto even where others may have been persuaded otherwise.

One could be more aggressive and get a local machine shop to weld some steel bearings onto the end of rebar sticks. (Rebar sticks are used to reinforce concrete.) These units could be mounted with concrete like miniature fence posts for a more permanent and durable display. Accurate paintings are probably not important and the relative distances between planets could be represented successfully across a 100 foot backyard.

Building a Backyard Model

Simply adjust the actual distances between planets proportionally to fit the 100 foot span. Sizes and distances in this article are approximate but more than accurate enough for a nice solar system model. The Moon (our moon!) might also be included since we're all so accustom to seeing our closest neighbor. Table 1 shows both the actual distances from the Sun (approximate) and the adjustments to fit 100 feet. The moon's values are shown as distance from Earth, not the Sun. Of course, the Sun starts at position zero.

From the Sun	Mercury	Venus	Earth	*Moon*	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Actual Distance *Millions* of Miles	**36.25**	**67.5**	**93.75**	**.25**	**142.5**	**487.5**	**893.75**	**1,794**	**2,813**	**3,688**
Backyard Distance in Ft. & In.	**1**	**1' 10"**	**2' 8"**	**1/10"** from Earth	**3' 10"**	**13' 3"**	**24' 3"**	**48' 8"**	**76' 4"**	**100'**

Table 1. Shows both actual distance in millions of miles and conversion to 100 foot model. Moon is shown same scale but distance from Earth.

So, after preparing your planet models on sticks, get your tape measure and you're ready to go. Figure 1 shows a scale graphic to illustrate the relative distances of each planet.

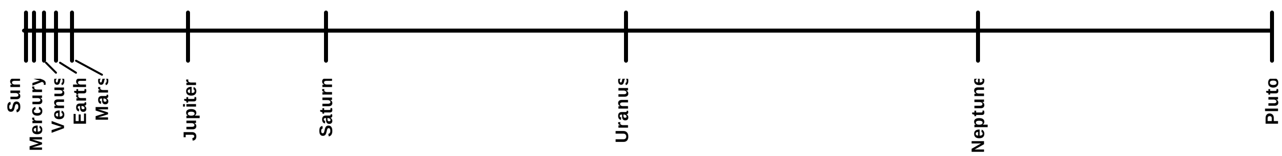

Figure 1. Graphic illustration of approximate relative distances within the solar system.

Clearly, as the table and figure above illustrate, all of the inner planets from the Sun through Mars will be tightly grouped in the model. Only the large gaseous, outer planets will be spaced very far apart in your model.

What About Size?

Not all of the planets are the same size. Sure, one could make the Sun, Jupiter and Saturn large; make Uranus and Neptune medium; make Venus, Earth and Mars small; and perhaps make Mercury and Pluto very small. This might add a touch of realism to the overall model but it would of course not be accurate. In fact, it wouldn't even be close. The sizes vary greatly and this is where the problem really lies. If your model is to reasonably represent both distance and size this could prove to be very difficult. Consider using a basketball (approximately 12" diameter) as the Sun. Painted bright yellow in your backyard, even your neighbors would be impressed. Maybe use florescent paint and get everyone involved all through the night. Joking aside, consider the sizes of all the planets (Table 2) if you use a basketball as the Sun:

Planet	Model Size in Inches	Note
Sun	12.00	Basketball … good size display in your backyard.
Mercury	.04	Perhaps a small grain of sand??
Venus	.10	Could use a BB… or tiny ball bearing
Earth	.11	Could also use a BB… just like Venus
Moon	.03	*- Just give up on this one*
Mars	.06	Maybe try another grain of sand.
Jupiter	1.23	Maybe use a golf ball.. this seems reasonable
Saturn	1.04	Perhaps a ping pong ball.. also reasonable
Uranus	.44	A common marble might work nicely
Neptune	.43	Try a marble … like Uranus.
Pluto	.02	*I don't think so…. that's very tiny… and I couldn't even see it.*

Table 2. Shows planet sizes to scale starting with a 12 inch Sun.

Still, as small as this is, with Pluto being only 2 hundredths of an inch wide, you could do the model. Maybe cut your grain of sand in half for Pluto and forget about painting it. However, the distances are now a problem. If you start with the Sun as a basketball (about 12") then you could not keep Pluto in your own yard. Pluto – your ½ grain of sand - would have to be mounted almost a mile away from your house.

In order to keep both the distance and size to the correct scale for your backyard (100'), you would have to use a small pea from the salad bar as the sun – about ¼ inch diameter. Unfortunately, Pluto, at 100 feet away, would only be about 5/10,000ths of an inch in diameter – but at least it would still be in your yard. I guess you'd have to invest in a microscope in order to see it.

Larger Model

So, let's build a model with sizes that are large enough to actually see even Pluto. Starting with the size of the sun is difficult because it is always a surprise just how small and how far away Pluto really is. Let's start with Pluto. How small can we make Pluto and still be able to see it or show it to somebody. Just to play it safe, because we don't want our model of the sun to be as large as a house or a building and we don't want it to be located in another town, let's setup things as small as possible.

Perhaps we could keep Pluto about the size of a BB. One could still create a 10 inch square plaque and superglue the BB to the center of it. One could use the extra space for a label or other information about the planet. Such a plaque could be mounted on a small fence post or a tree (with owner's permission of course). At least, anyone could walk up to the plaque and actually see Pluto (the BB) clearly, even though very small.

So, how big would the Sun be and how far away? Since the Sun is so much bigger than everything else, it will be the only really large item in the model. Everything else is very manageable. The Sun turns out to be 5 Feet in diameter. This might seem to be too large to build a 5 foot diameter yellow ball but there is an alternative. Figure 2 shows how to use 2 separate plagues placed 5 feet apart to represent the overall size of the Sun as a 5 foot ball. Just use two plaques to show the top and the bottom of the Sun. Some sort of information directing the viewer to the rest of the model might also be useful here.

Figure 2. Shows how to display the Sun 5 ft. tall with 2 plaques.

Table 3 illustrates a complete model that you might build in your community with distance in miles/feet and size in inches. For each of the planets, you might use the idea of a plaque as a mounting base for the planet model. The Moon is again shown in distance from Earth. The Sun of course starts at zero and Pluto is 4 miles away. This may seem far but it might be very practical for your local community.

Planet	Model Distance	Size in Inches	Note
Sun	0 (zero)	60.00	Use 2 plaques (see figure 2)
Mercury	211 ft.	.21	Use a small ball bearing
Venus	391 ft.	.52	Perhaps use a ½ " marble
Earth	543 ft.	.56	Also use a ½" marble
Moon	1' 4"	.15	Use a BB… distance from Earth
Mars	826 ft	.30	A smaller marble or ball bearing
Jupiter	½ mile	6.22	Find a 6" ball.
Saturn	1 mile	5.22	Maybe a Softball
Uranus	2 miles	2.22	Maybe a Tennis Ball
Neptune	3 miles	2.15	Maybe a Racquetball
Pluto	4 miles	.10	Use the BB here

Table 3. Shows a 4 mile scale model in size and distance.

Obviously, you don't have to be exact for the hundredths of an inch for a model to appear to accurately represent the correct size and distance. Also, if you're using a plaque to display the planet and to hold information about the model, then you could also use two-dimensional displays. That is, simply cut a round wooden disk to the specified size. Then painting and mounting could be much easier. Either way, a 4 mile model is a doable thing.

You might even get local businesses to contribute the cost of each plaque especially if their sponsorship is noted on the planet's plague. Perhaps if you're lucky, you might find a business district across the 4 mile stretch where individual shops, properly placed, could host the placement of a planet. The 10 solar system businesses could become quite famous in the community. Too, the model might get more notice than if it is placed on a back trail somewhere.

In any event, for such a large model, be sure to acquire all of the necessary and appropriate permissions from the community and property owners when planning the model. Be sure to get local newspapers to cover an unveiling ceremony for the model. Any newspaper will be happy to write an article and publicize the new addition to the community. Call local schools to let teachers know about the model so they can encourage their students to check it out. And, finally, tell them where you got the idea.

Galloway, J. P. (2007). The planet that disappeared. *Amateur Astronomy Magazine, 53*, p.28-29.

Author Biography:

Dr. Jerry P. Galloway has served as a Professor of Instructional Technology for 20 years at the University of Houston, Indiana University NW, and Georgia Southern University and has published dozens of articles, books and electronic media. As an amateur astronomer, he operates the Jacqueline Rose Observatory with an LX200GPS-14". He also serves as the astronomy lecturer for Royal Caribbean Cruise Lines. See his site at:

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