

# The Peppercorn Model of the Solar System

Eric Myers



*Mid-Hudson Astronomical Association  
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# The Peppercorn Model

The peppercorn model is a scale model of the solar system which demonstrates at the same time both the sizes of the planets and the distances between them.

The Earth is the size of a peppercorn, 26 yards from the Sun, which is the size of a bowling ball. Pluto is just over 1000 yards from the Sun.

*Or, the Sun is the size of your head, and the Earth is the size of the pupil of your eye.*

But the peppercorn model is something you do, not just something that you see or hold or touch. It's the experience, not just the object.


www.noao.edu/education/peppercorn/pcmain.html

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VOAO > Educational Resources

**National Optical Astronomy Observatory**  
 Kitt Peak National Observatory • Cerro Tololo Inter-American Observatory • NOAO Gemini Science Center

- Introduction
- Pacing off the Solar System
- Additional Notes
- Beyond the Solar System
- Numerical Summary



## THE THOUSAND-YARD MODEL or, The Earth as a Peppercorn

Copyright 1989 by Guy Ottewell  
**Universal Workshop**  
 PO Box 102  
 Raynham, MA 02767-0102  
 Toll Free: 800-533-5083  
 Fax: 508-967-2702  
 Email: [customerservice@universalworkshop.com](mailto:customerservice@universalworkshop.com)

This is a classic exercise for visualizing just how BIG our Solar System really is. Both the relative size and spacing of the planets are demonstrated in this outdoor exercise, using a mere peppercorn to represent the size of the Earth. Guy Ottewell has kindly given permission for this electronic presentation of The Thousand-Yard Model; his exercise is presented in its original form, indexed with a few anchors to help you find your way around the large file. We also include [a catalog](#) describing several Ottewell publications. Image of the planets courtesy of [NASA](#).

### Introduction

Can you picture the dimensions of the solar system?

Probably not, for they are of an order so amazing that it is difficult either to realize or to show them.

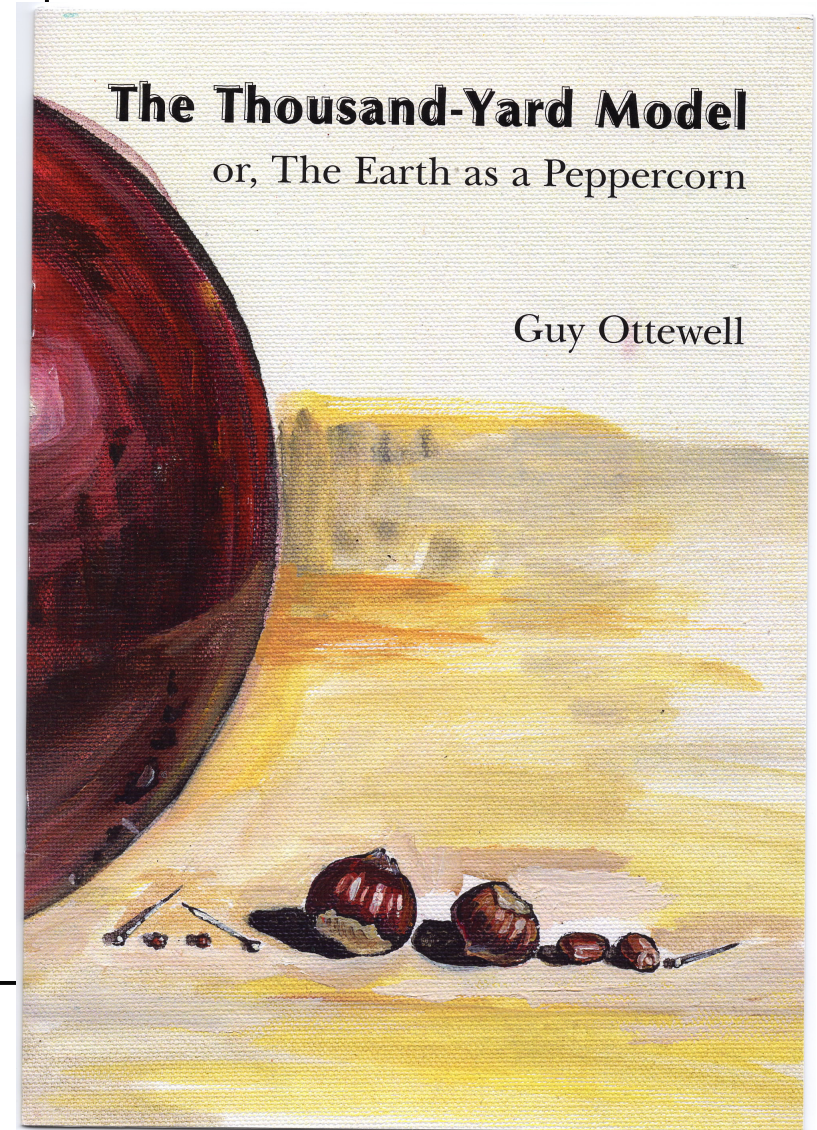
You may have seen a diagram of the Sun and planets, in a book. Or you may have seen a revolving model of the kind called an orrery (because the first was built for an Earl of Orrery in 1715). But even the largest of such models--such as those that cover the ceilings of the Hayden Planetarium in New York and the Morehead Planetarium at Chapel Hill--are far too small. They omit the three outermost planets, yet still cannot show the remaining ones far enough apart.

The fact is that the planets are mighty small and the distances between them are almost ridiculously large. To make any representation whose scale is true for the planets sizes and distances, we must go outdoors.

The following exercise could be called a Model, a Walk or a Happening. I have done it more than twenty times with groups of varied ages (once we were televised) or with a single friend; and others, such as elementary-school teachers, have carried it out with these instructions. Since it is simple, it may seem suitable for children only. It can, indeed, be done with children down to the age of seven. Yet it can also be done with a class consisting of professors of astronomy. It will not waste their time. They will discover that what they thought they knew, they now apprehend. To take another extreme, the most uncontrollable high-school students or the most blase college students unfailingly switch on their full attention after the first few paces of the excursion.

There is one other party that may profitably take the planet-walk, and that is yourself, alone. Reading the following description is no substitute: you must go out and take the steps and look at the distances, if the awe is to set in.

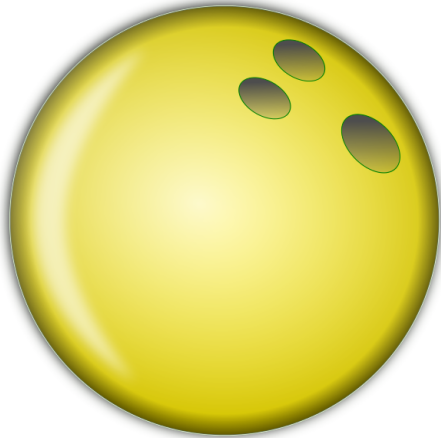
First, collect the objects you need. They are:



Length: 1020 yards

Scale: 1 : 6,336,000,000

# Inner Planets



**The Sun**

a Bowling Ball  
*about 8" diameter*



**Mercury**  
a pinhead  
*10 yards*



**Venus**  
A peppercorn  
*19 yards*



**Earth**  
a peppercorn  
*26 yards*



**Mars**  
a pinhead  
*39 yards*



# Outer Planets



**Ceres**

a grain of salt  
*72 yards*



**Saturn**

an acorn  
*247 yards*



**Neptune**

a coffee bean  
*777 yards*



**Jupiter**

a walnut  
*134 yards*



**Uranus**

a coffee bean  
*497 yards*



**Pluto**

a grain of salt  
*1014 yards*

# Hackett Hill Park

## Hyde Park, NY

# Exercise for summer campers for town of Hyde Park

Not enough room for  
a straight line path!





# Dutchess County Rail Trail

Poughkeepsie, NY

Starting at Morgan Lake,  
ending just before Grand Avenue

Scale: 1 : 6,336,000,000

[Map](#)

[KML](#)





# SUNY New Paltz

New Paltz, NY

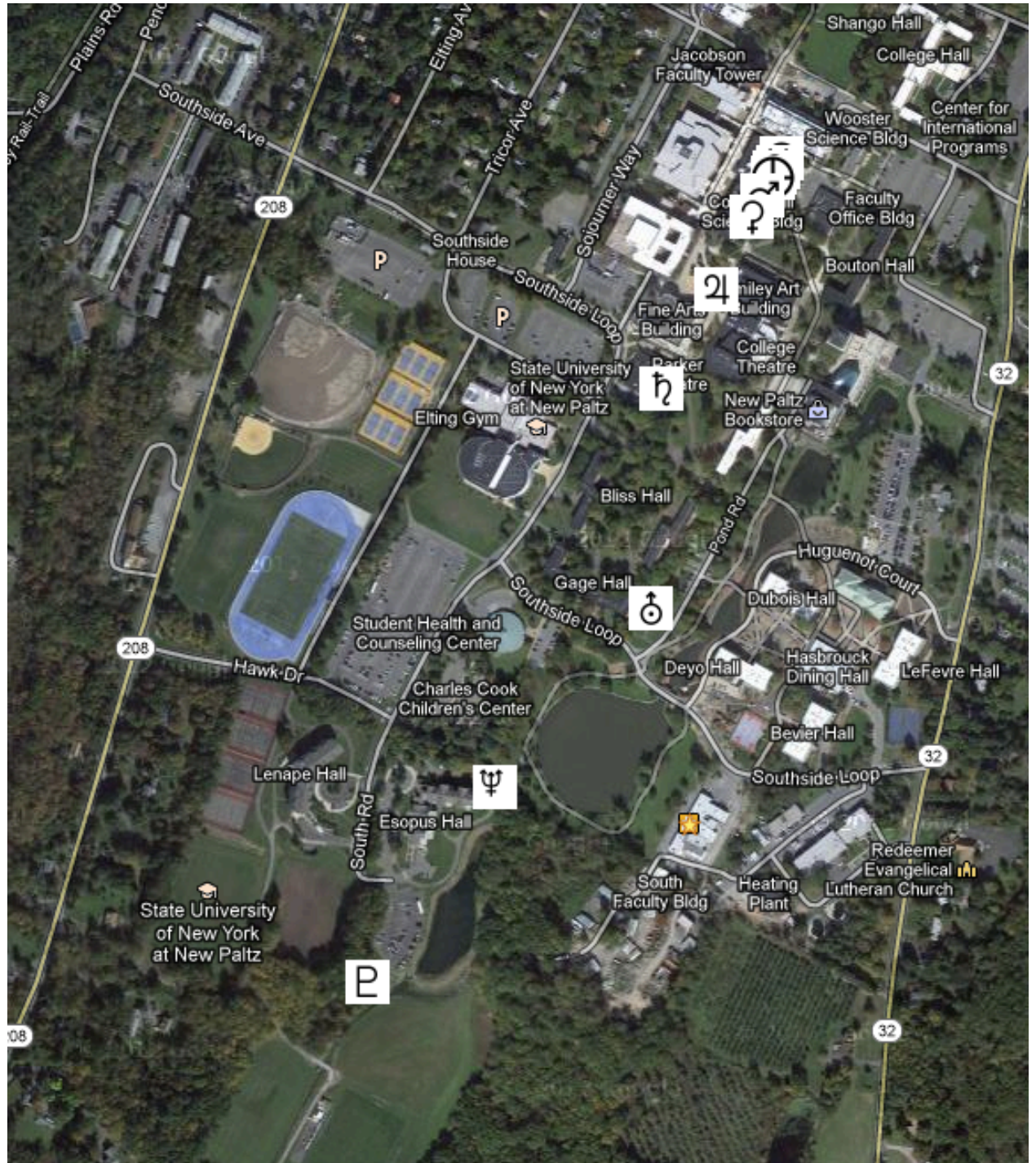
Scale: 1 : 6,336,000,000

Starting at Planetarium,  
ending just before the  
Smolen Observatory

It fits great!

[Map](#)

[KML](#)





On Line: <http://www.spy-hill.com/myers/peppercorn>

## The Peppercorn Model of the Solar System

*The Peppercorn Model, also known as the Thousand Yard Model, is a scale model of the solar system which shows at the same time, on a linear scale, both the sizes of the planets and the distances between them. At this scale, the Earth is about the size of a peppercorn, and Pluto is a pin-point about 1000 yards from the Sun.*

Object	Diameter of Model Object		Distance	Added distance		Total distance	
	inches	Object		yards	meters	yards	meters
Sun ☉	8.7"	a bowling ball	22 cm	0.00		0 yd	0 m
Mercury ☿	0.03"	a pin head	0.08 cm	0.39	+10 yd +9 m	10 yd	9 m
Venus ♀	0.08"	a peppercorn	0.19 cm	0.72	+9 yd +8 m	19 yd	17 m
Earth ⊕	0.08"	a peppercorn	0.2 cm	1.00	+7 yd +7 m	26 yd	24 m
Mars ♂	0.04"	a pin head	0.11 cm	1.52	+13 yd +12 m	39 yd	36 m
*Ceres ♄	0.01"	a grain of salt	0.02 cm	2.77	+32 yd +29 m	72 yd	65 m
Jupiter ♃	0.89"	a walnut, or chestnut	2.3 cm	5.20	+63 yd +57 m	134 yd	123 m
Saturn ♄	0.75"	an acorn or hazelnut	1.9 cm	9.58	+113 yd +103 m	247 yd	226 m
Uranus ♅	0.32"	a coffee bean	0.81 cm	19.20	+249 yd +228 m	497 yd	454 m
Neptune ♆	0.31"	a coffee bean	0.78 cm	30.10	+281 yd +257 m	777 yd	711 m
*Pluto ♇	0.01"	a grain of salt	0.04 cm	39.30	+237 yd +216 m	1014 yd	927 m
* dwarf planets	inches		cm	AU	yards meters	yards	meters

On this scale the nearest star, Proxima Centauri, would be about 4,000 miles away!

1 AU = 1 Astronomical Unit = average (mean) distance between the Earth and the Sun =  $1.4960 \times 10^{11}$  meters =  $9.2956 \times 10^7$  miles

Scale: 1 inch = 100,000 miles

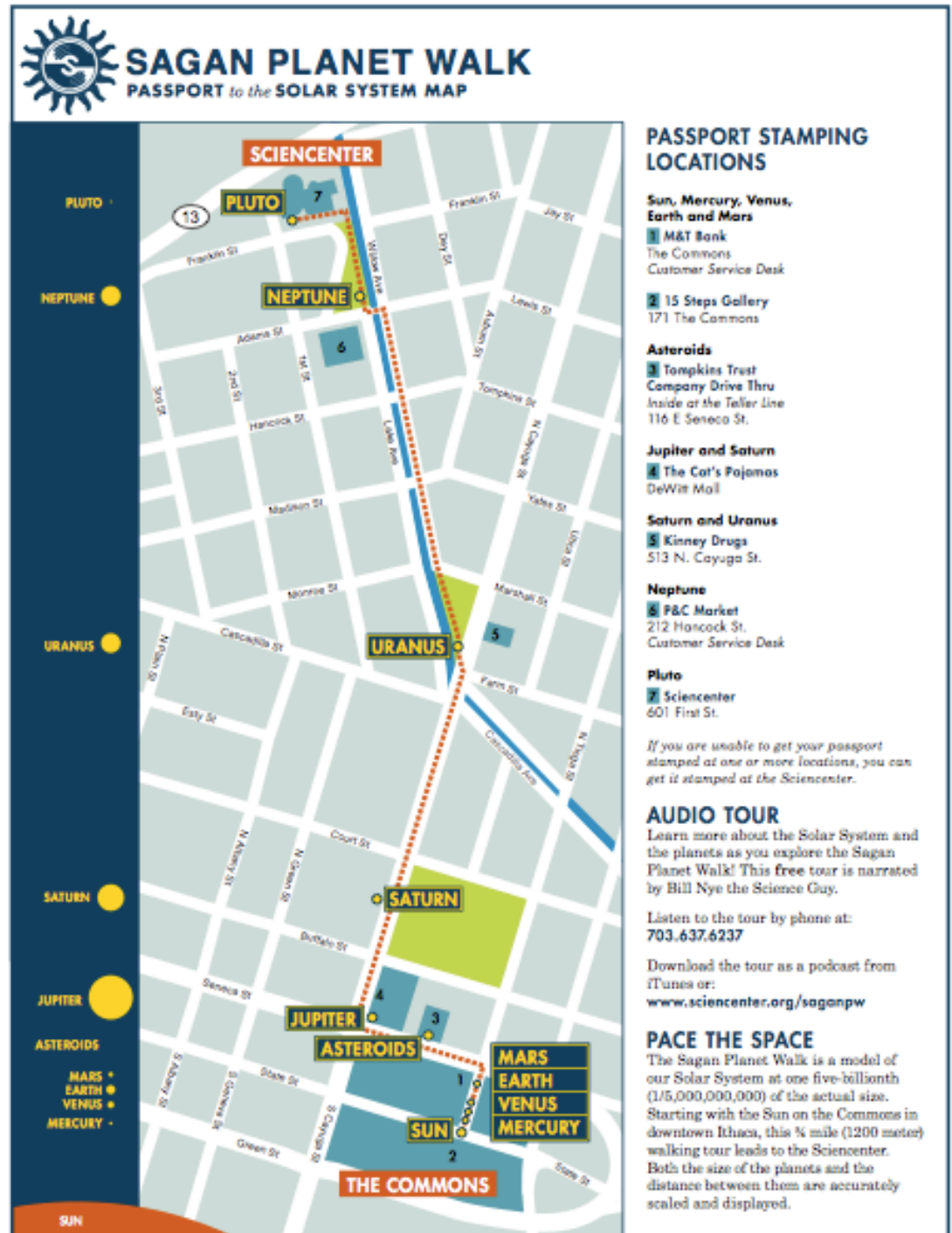
# Sagan Planet Walk

## Ithaca, New York

Scale: 1 : 5,000,000,000

Length: 1200 meters

Get your passport stamped  
at local shops





## Capital Mall Washington, DC

Scale: 1 : 10,000,000,000



*“On the scale of the Voyage exhibition, the Sun is the size of a large grapefruit in Washington, DC, Earth is smaller than the head of a pin 50 feet (15 m) west of the Sun, and the nearest star to the Sun, Proxima Centauri, is the size of a cherry on the California coast.”*



A tour of Voyage begins at the Sun for a Washington, D.C. class of sixth grade students.  
Credit: Washington Times, 2000





## BECOME A VOYAGE COMMUNITY

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### BECOME A VOYAGE COMMUNITY

PACKAGE OF RESOURCES

SUPPLEMENTARY PROGRAMS

COMMUNITY BENEFITS

MILESTONES

TESTIMONIALS

**COSTS**

EXHIBITION

EDUCATION

EXISTING COMMUNITIES

MEDIA

GALLERY

RALLYING SUPPORT IN YOUR COMMUNITY

VOYAGE AND PLUTO

### COSTS TO BECOME A VOYAGE COMMUNITY

The total cost per *Voyage Community* is \$250,000, and includes:

- The complete exhibition of 13 stanchions, with customized site maps and acknowledgment of funders on the storyboards.
- An installation manual and installation support from National Center for Earth and Space Science Education staff.
- Master files of the *Voyage* K-12 Education Lessons and family/home activities.
- A Professional Development workshop for up to 60 educators, and a public/family program.
- Ongoing support from our educators and planetary scientists.



[Zoom](#)

*Voyage* ribbon cutting on opening day, October 17, 2001.

Credit: ©Smithsonian Institution, Jeff Tinsley

The cost reflects full cost recovery by the National Center for Earth and Space Science Education.

There are also a number of real and potential additional costs borne by the community that must be considered:

- Delivery of the exhibition.
- Site preparation, at a minimum requiring construction of 13 small concrete footings.
- Regular exhibition cleaning.
- Insurance against vandalism.
- Copying of grade K-12 lessons, and family/home activities for dissemination to the general visitorship, educators, and families.
- Bulk purchase of Outdoor Exploration Guide (customized tour brochure).



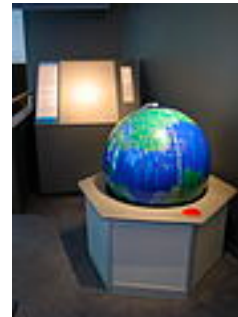
# Sweden Solar System

Scale: 1 : 20,000,000

Sun's diameter is 110 m (includes corona)



Earth's diameter is 65 cm (moon 18 cm),  
7.6 km from the Sun



Jupiter's diameter is 7.5 m,  
40 km from the Sun



Neptune's diameter is 2.5 m,  
229 km from the Sun

Pluto's diameter is 12 cm,  
300 km from the Sun



# Theodor Jacobsen Observatory of the University of Washington

In the  
Seattle  
Olympic Sculpture  
Park

March 10, 2007  
1 to 2 PM



# Installation or Event?

“Golf is a good walk spoiled.”  
- Mark Twain

Is it better to do the walk as an event, or create a permanent installation?

## Event

1. Counting out paces focuses attention on the distances and relative scales. You *feel* it.
2. Adds a sense of adventure as you find the next station.
3. Minimal cost.

“Professors of astronomy will discover  
that what they thought they knew,  
they now apprehend.”  
- Guy Ottewell

## Installation

1. Not distracted by counting paces, so it's easier to talk (about anything).
2. Exposure to casual visitors, spreading the idea wider.
3. Minimal preparation.

There is a list of scale model  
installations of all sizes on  
Wikipedia under  
[Solar System Model](#)



# Poughkeepsie Children's Museum

Poughkeepsie, NY

The thousand yard model doesn't fit!  
Only about 500 yards available.

Options:

1. Scale down by  $\frac{1}{2}$  to fit the site
2. Scale by about  $\frac{3}{4}$  to fit Neptune, but not Pluto. The Sun has a diameter of about 6 inches, which is about the size of a child's head!







## Poughkeepsie Railway Bridge

Length: 1.28 miles = 6758 ft = 2253 meters

To scale, that is 86 AU, so the Kuiper belt would fit (but not Sedna)

Or, simply double the distances of the Thousand Yard model and it still fits.

Or, put the Sun in the middle and mark distances to the planets on both sides of the bridge, as lines or curves. You don't just walk out of the solar system, you cross it!

# What can we do?

“That’s nice.”

(or perhaps “Wow!”)

Tell others.

Do the walk on your own, or with a friend.

Do the walk before meetings.

Do the walk before star parties.

Do the walk at special events.

Build portable stations.

Find other suitable locations.

(Tell me! [EricMyers47@gmail.com](mailto:EricMyers47@gmail.com))

Save acorns and walnuts.

Make a kit.

Create an App.

# Suggestions for the Rail Trail



Benches at Earth and the outer Planets



Marker Posts

Plant a Walnut tree at Jupiter, an Oak at Saturn.

# The Peppercorn Model

The peppercorn model (or the Thousand Yard model) is a scale model of the solar system which demonstrates at the same time, on a linear scale, both the sizes of the planets and the distances between them.

*Just the right size for both!*

The Earth is the size of a peppercorn (or the pupil of your eye), 26 yards from the Sun, which is the size of a bowling ball (or the size of your head).

Pluto is just over 1000 yards from the Sun. *Let's include Ceres.*

But the peppercorn model is something you do, not just something that you see or hold or touch. It's the experience, not just the object.

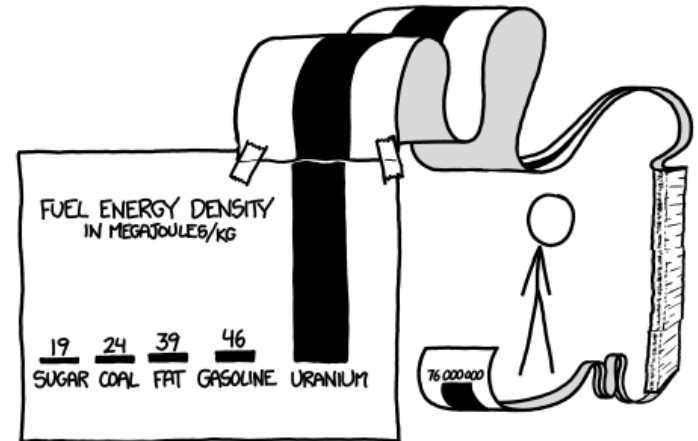
The peppercorn model can be an event, or it could be turned into a permanent installation. Either way, there are multiple sites in the area --- probably in every locality.



# Scales of the Universe

<http://htwins.net/scale2/>

<http://xkcd.com/1162/>



SCIENCE TIP: LOG SCALES ARE FOR QUITTERS WHO CAN'T FIND ENOUGH PAPER TO MAKE THEIR POINT PROPERLY.

