

**Reminder: no food or  
drinks in the planetarium!\***

# Astronomy 4 - Solar System Astronomy Reminders

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-Feel free to email me about course questions or astronomy in general.

Online Textbook:

<https://openstax.org/details/books/astronomy>

- Readings are listed on the class calendar.

Class website:

-<https://amcody.github.io/astro4>

Your one-stop shop for anything course related.

# Science is not...

- A list of previously known facts about nature
- A list of equations handed down from Ancient times
- A set of laws that were discovered by Dead White Guys a long time ago and are kept from the general public

# Science Is...

- a continuing process that
    - seeks to understand the rules and laws of nature
    - uses systematic observations
    - uses mathematical models
    - experimentally tests ideas
  - subject to independent verification
- These are the components of the scientific method (observe, theorize, predict, test and modify) used to comprehend the universe.

# What do Astronomers do?

- Make observations using telescopes
- Analyze data/results of observation
- Create theories about what is seen and what might exist yet unseen
- Create computer models that simulate what occurs in the universe
- Invent, design, and build instruments that let us see beyond the Earth!

BUT, most astronomers do NOT spend much time looking through telescopes

A scientific theory is a collection of ideas that explain a phenomenon in a way that is consistent with laws, observations and experiments.



Question:  
What are the main ways that  
scientists gather information about  
the Universe?

We observe light with telescopes on  
Earth and in space.

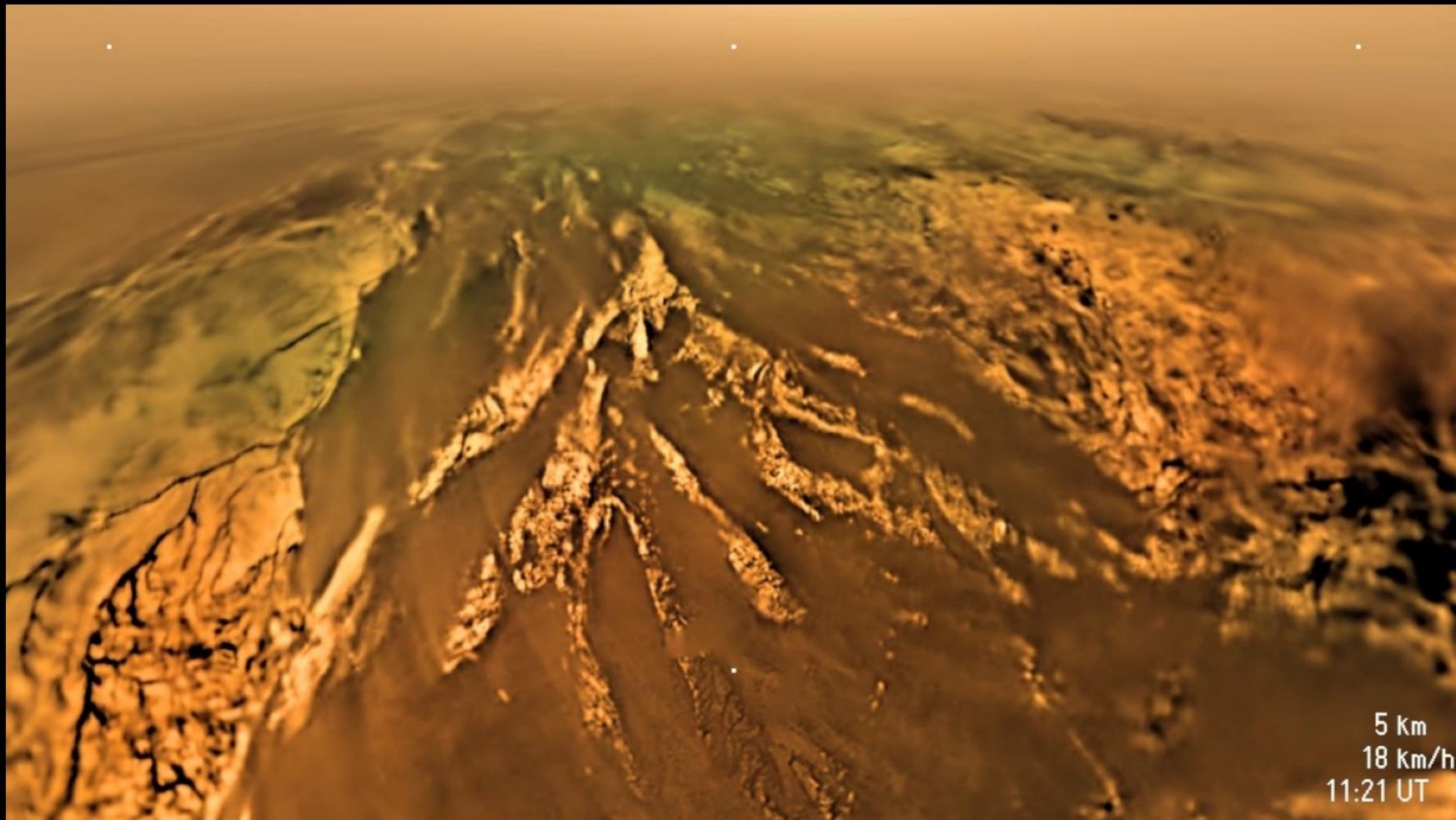


We send space probes to other  
objects in the solar system.



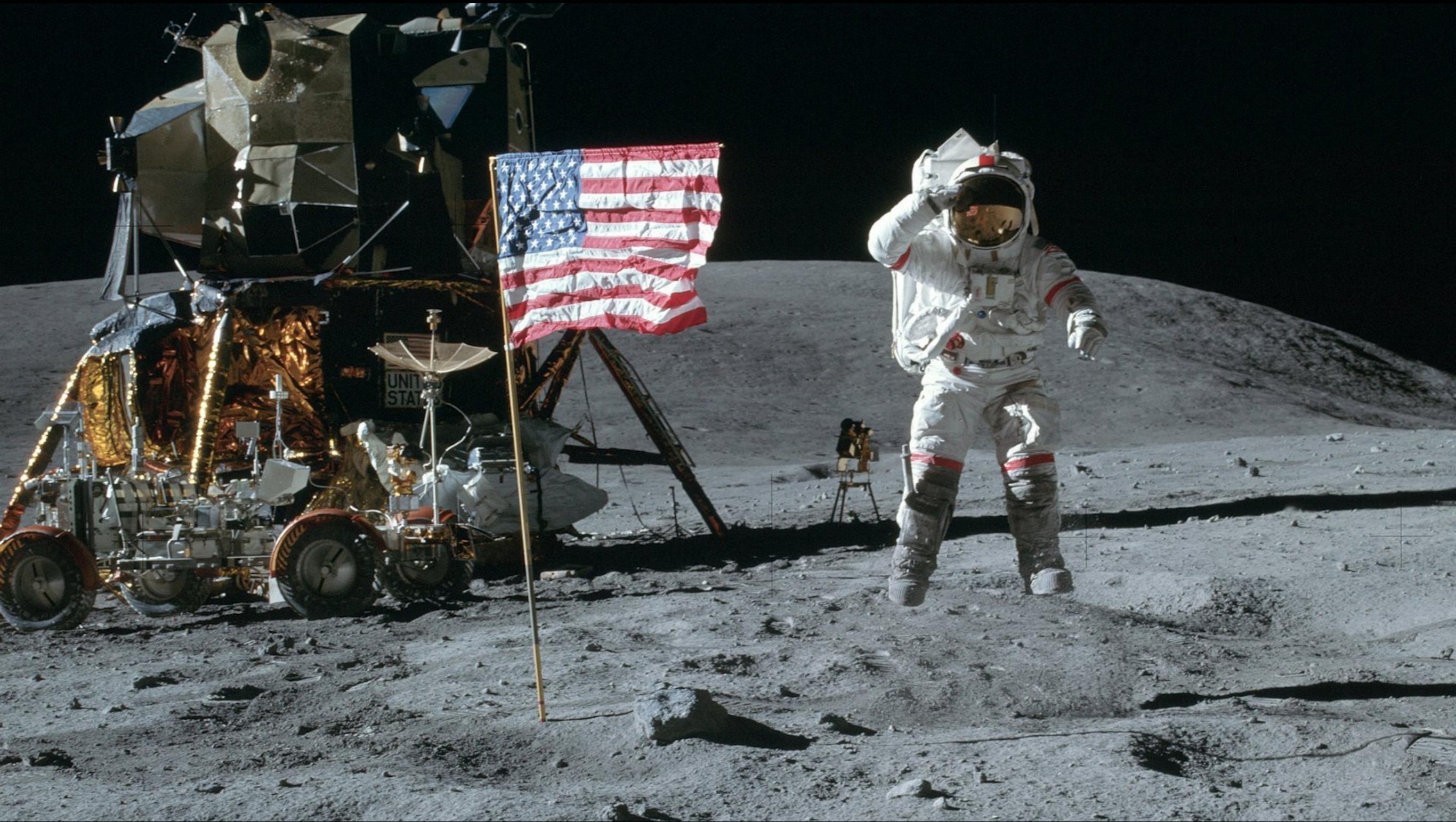
2004 Opportunity Landing Site – and tracks

2005: Huygens takes first images of  
Saturn's moon Titan and survives  
the crash landing!



We send astronauts into space.

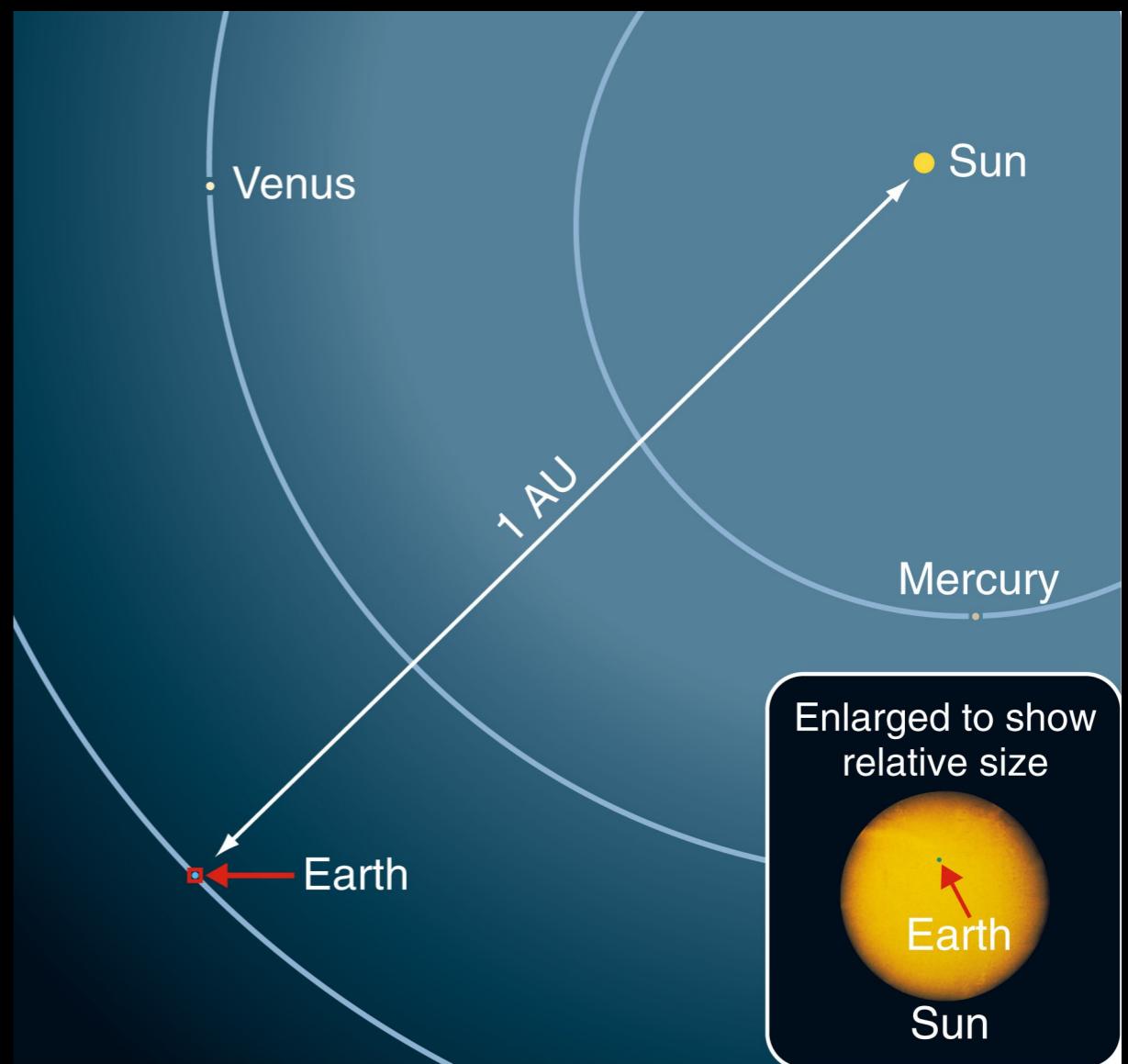
# 50<sup>th</sup> anniversary of the Apollo 11 moon landing



Let's take a brief tour of  
the Solar System  
and beyond...

The average distance from Earth to the Sun is called the **astronomical unit** (AU)—a distance of  $1.5 \times 10^8$  kilometers (93 million miles).

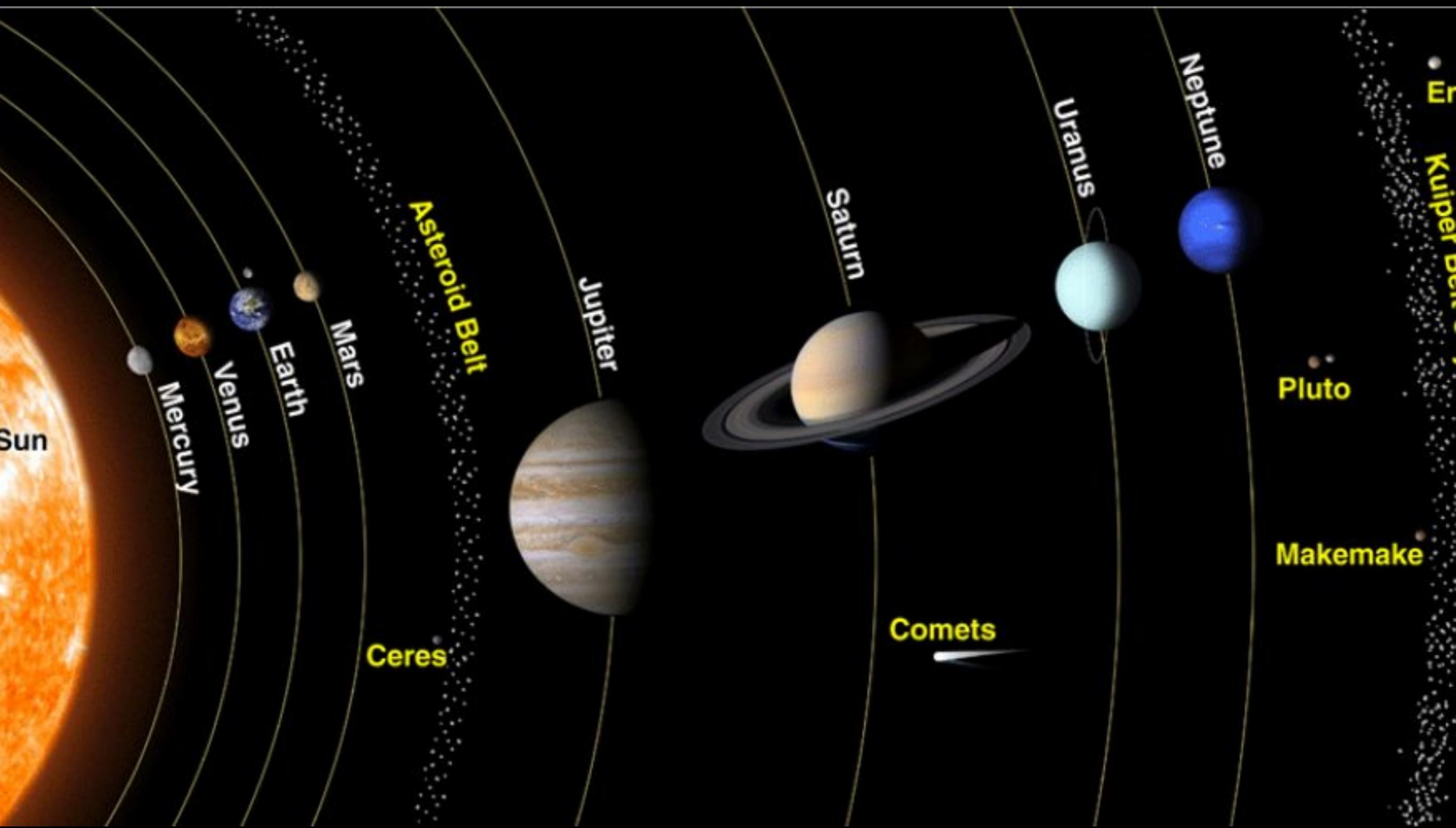
- For example, the average distance from Venus to the Sun is about 0.7 AU.



A **light-year** (ly) is the distance that light travels in one year—roughly  $10^{13}$  km or 63,000 AU.



# Scale of our Solar System

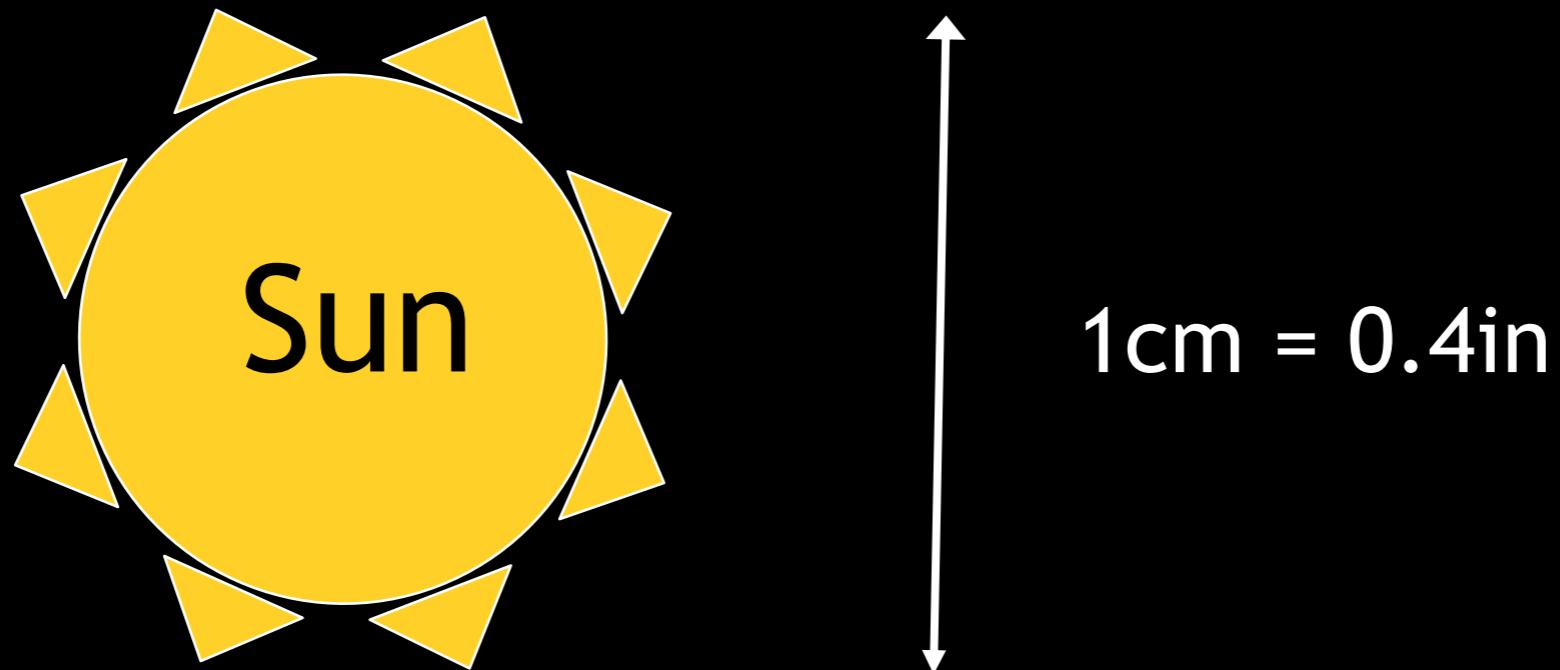


# Scale of our Solar System



# Scale of our Solar System

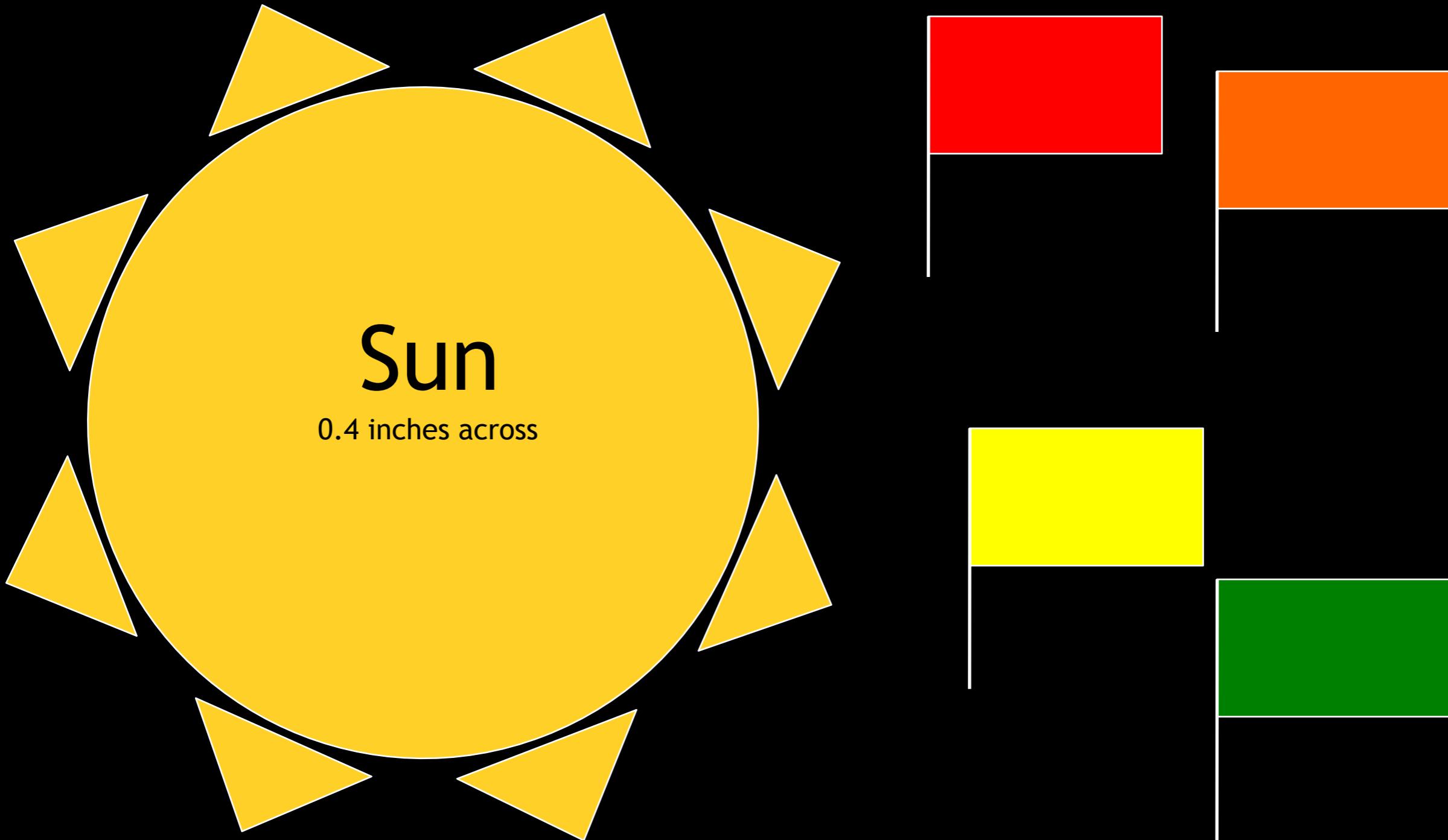
1 foot = 2,162,216 miles



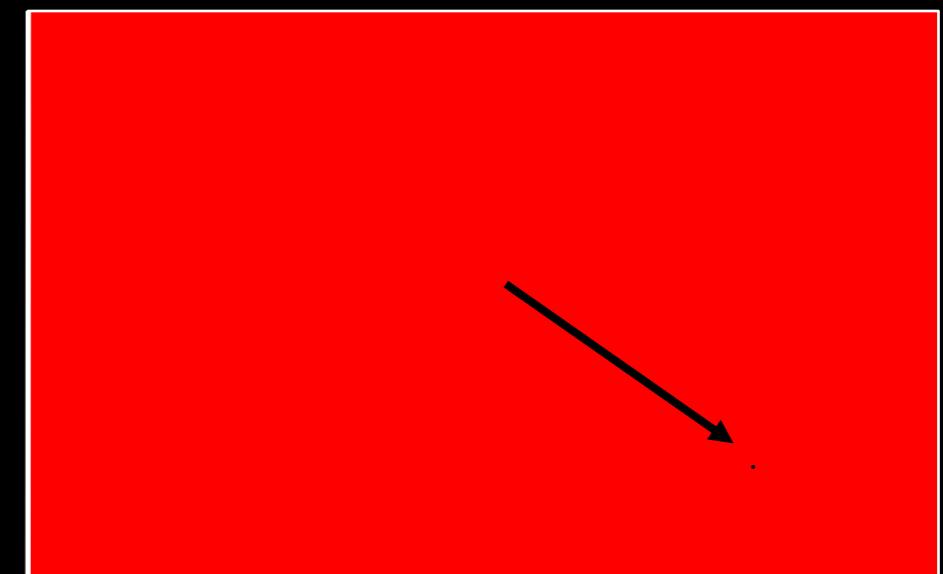
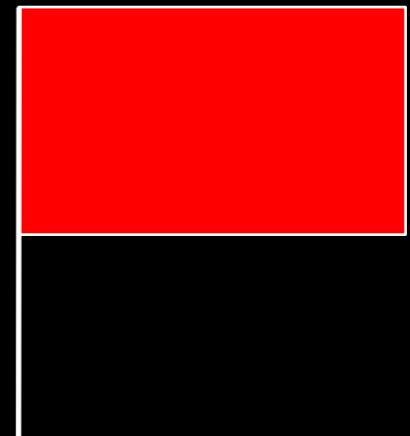
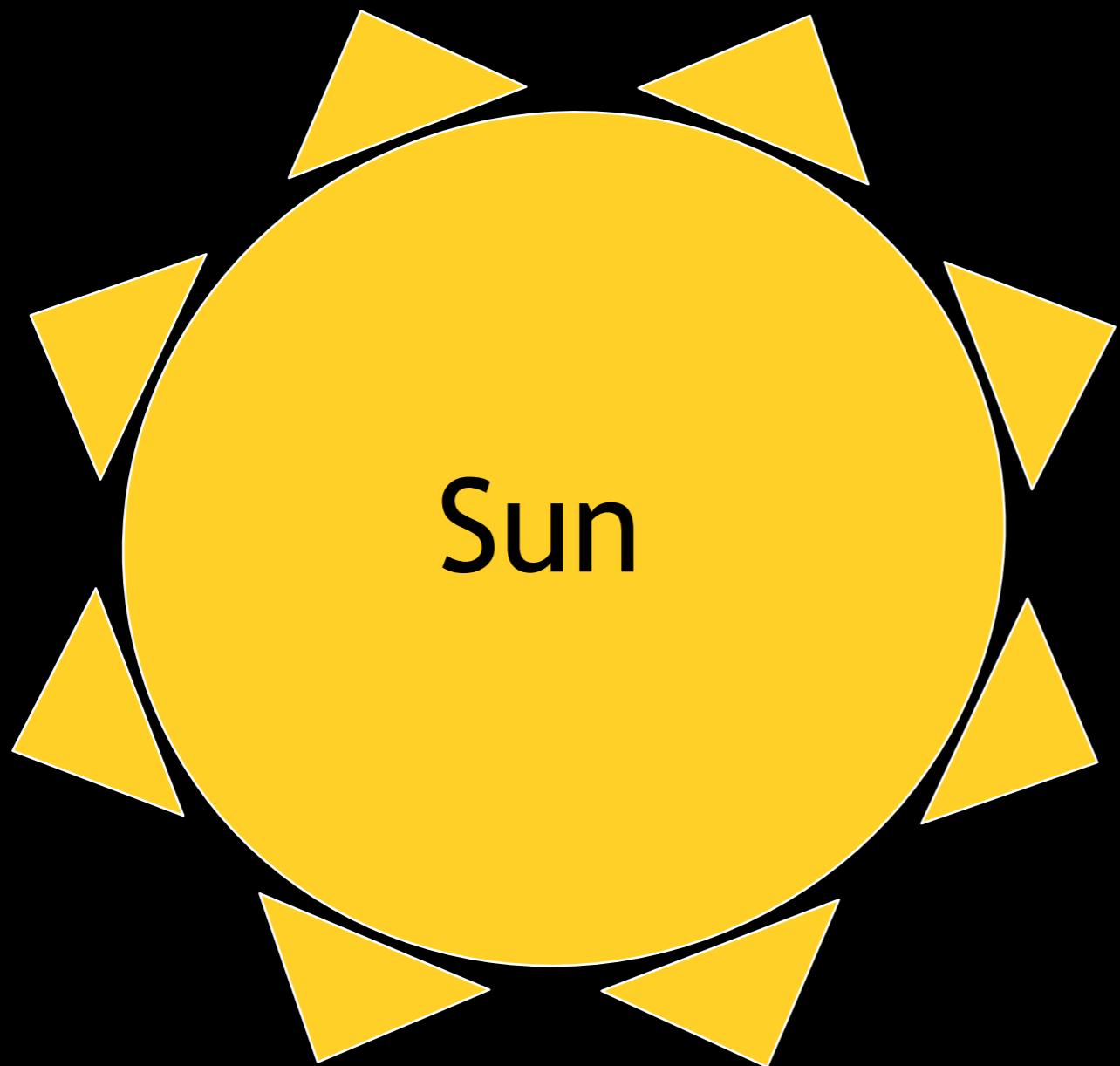
Will a scale solar system fit in the planetarium?

- A) YES!
- B) NO!

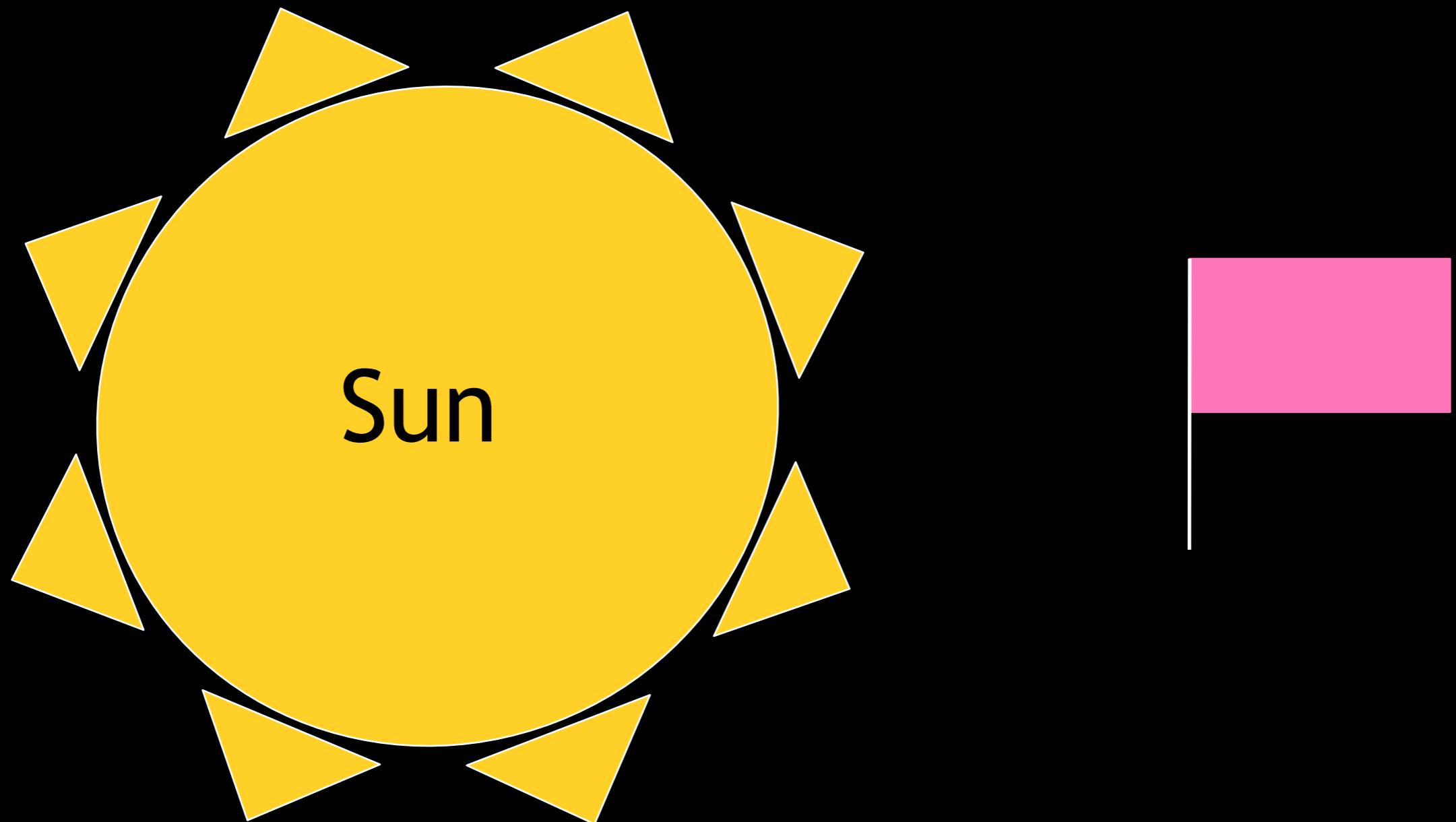
Using this scale, we map our solar system



Mercury:  
17 inches away

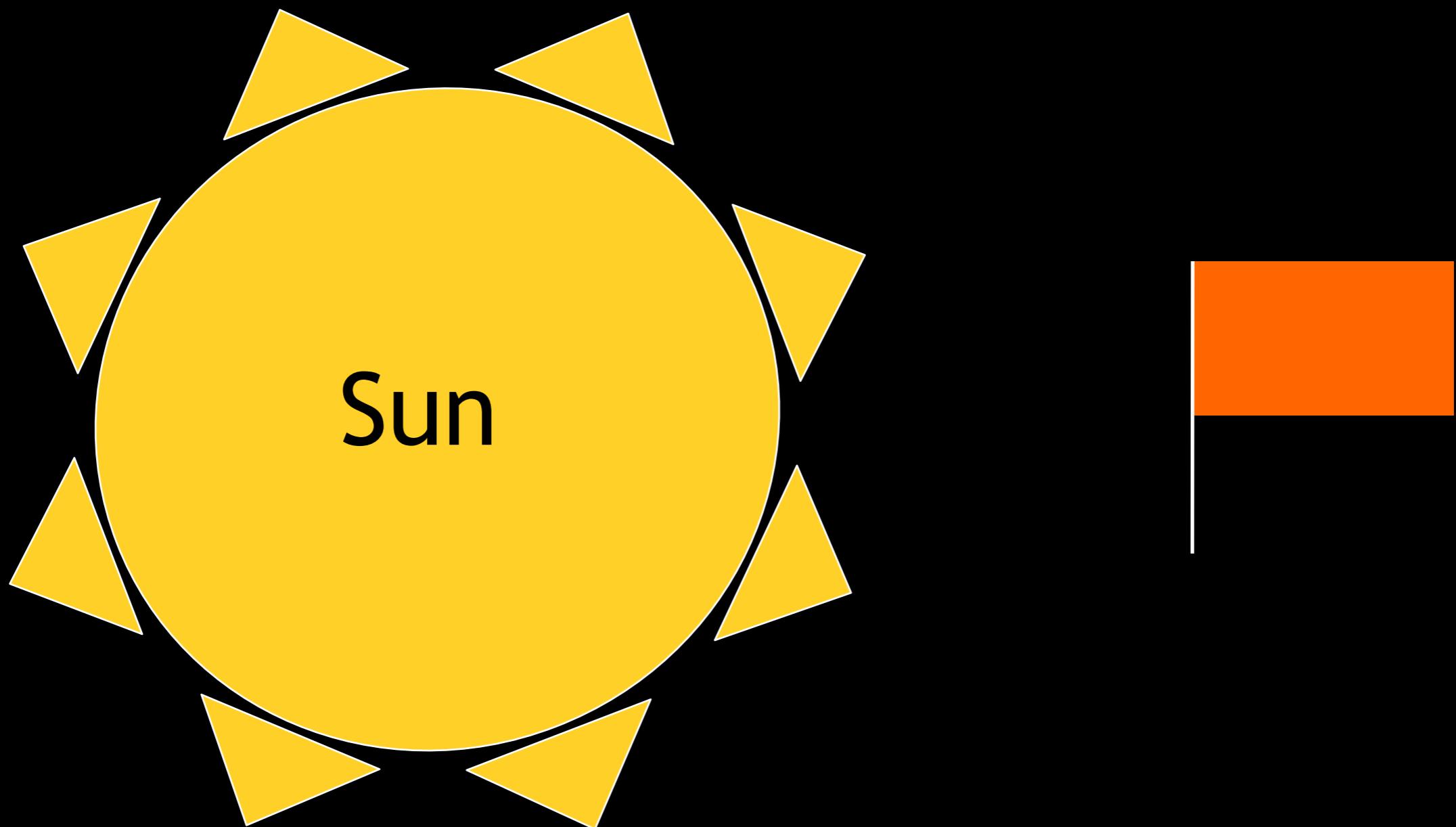


Venus:  
2.5 feet away



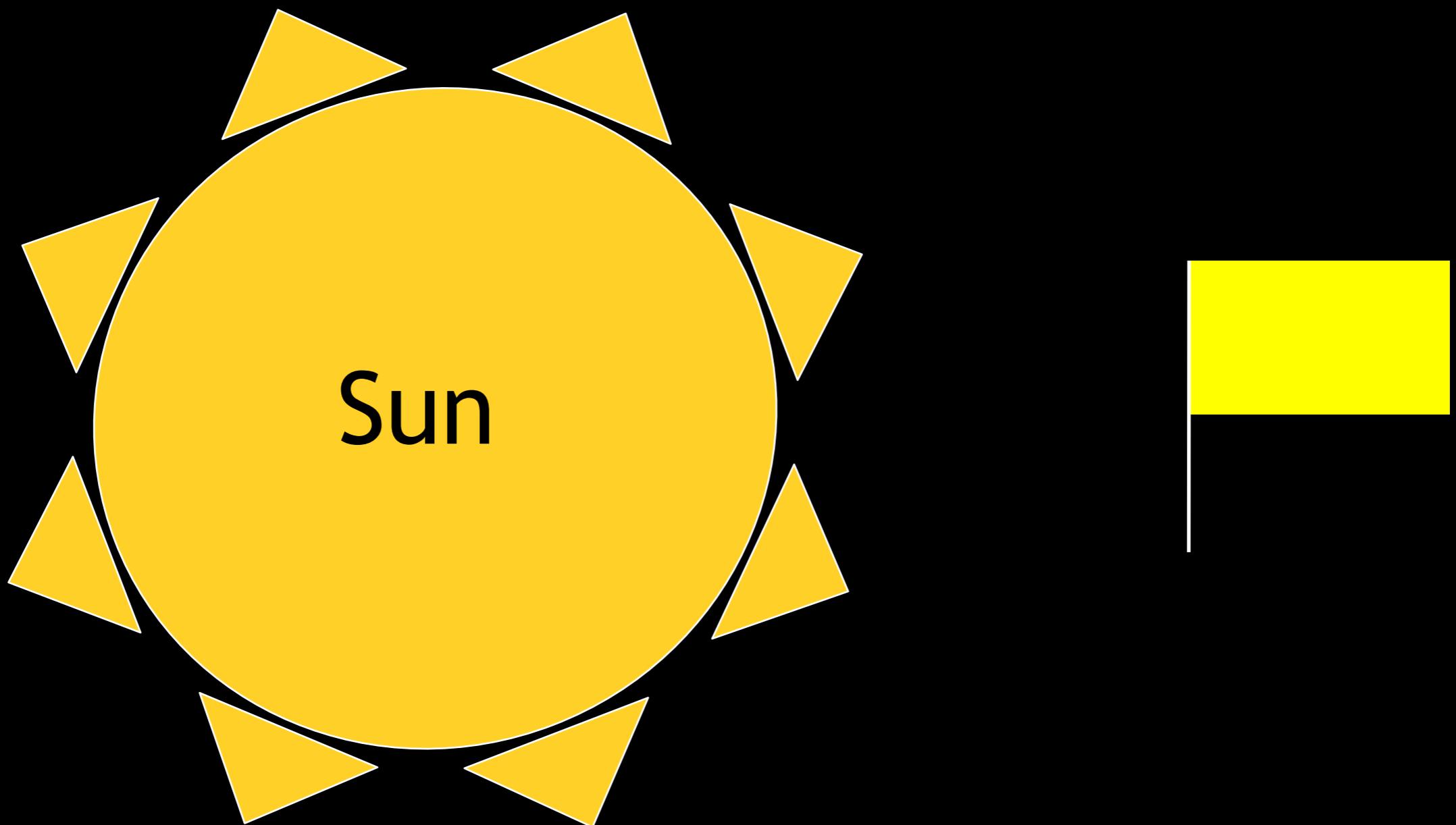
Earth:

3.5 feet away

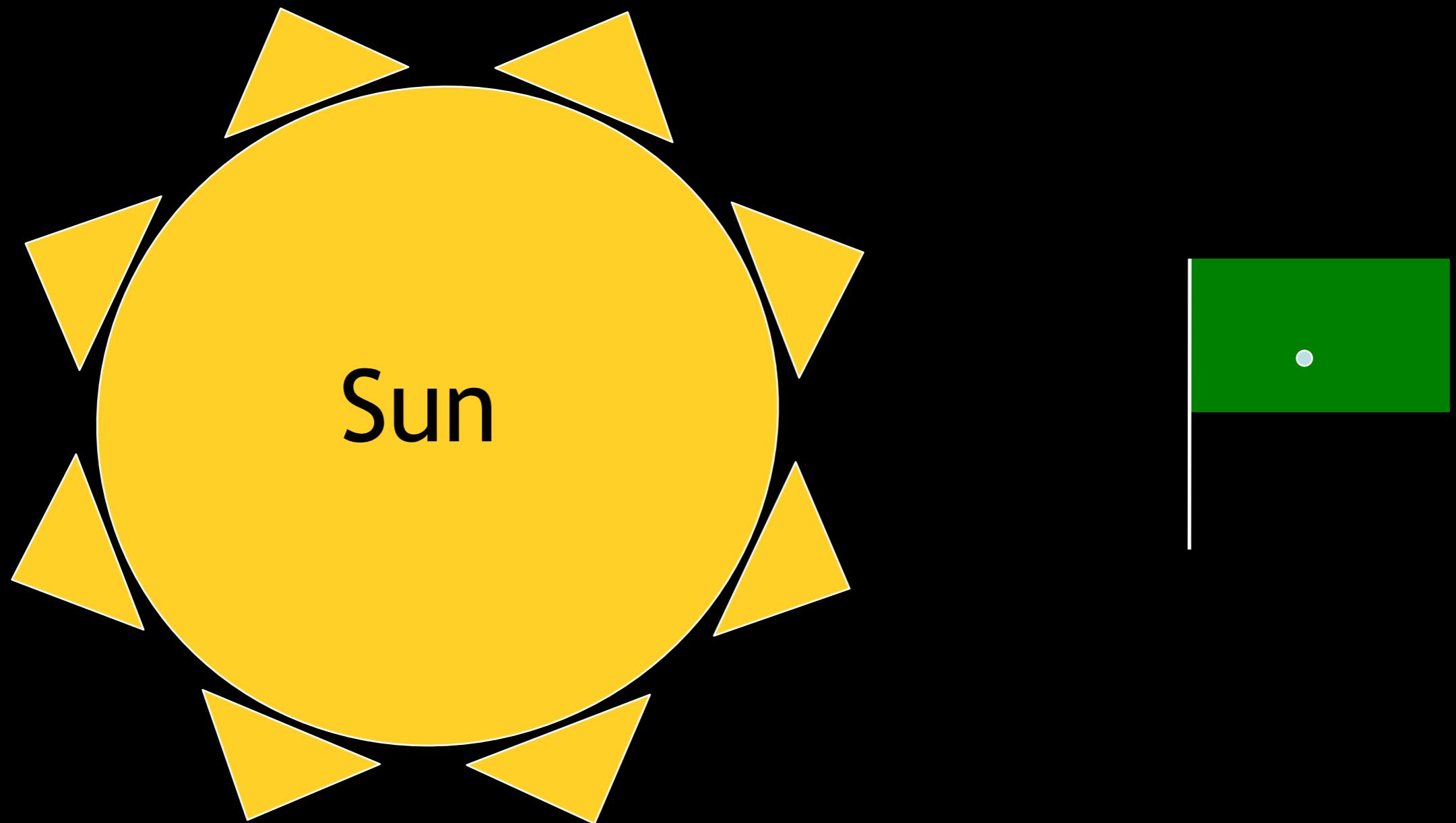


Mars:

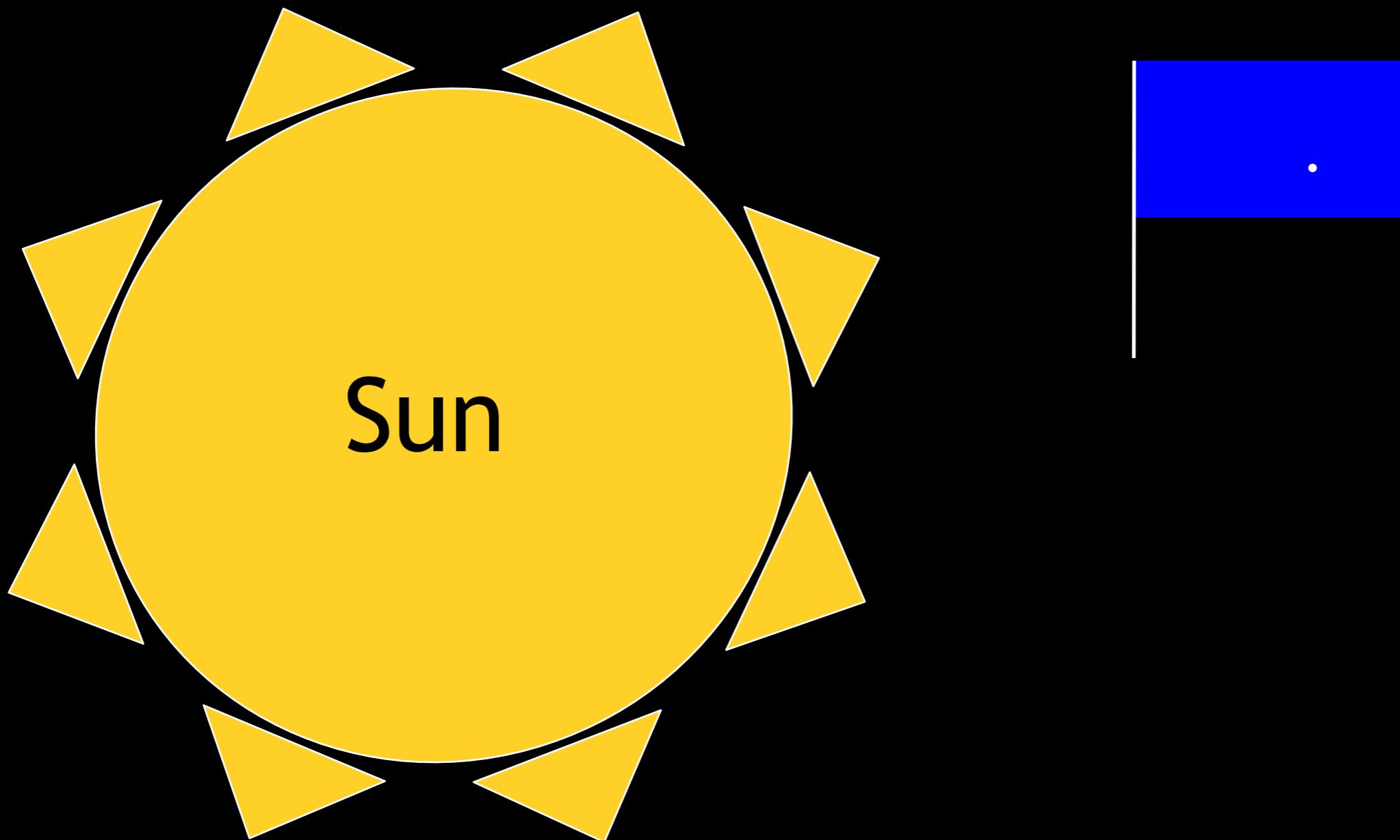
5.5 feet away



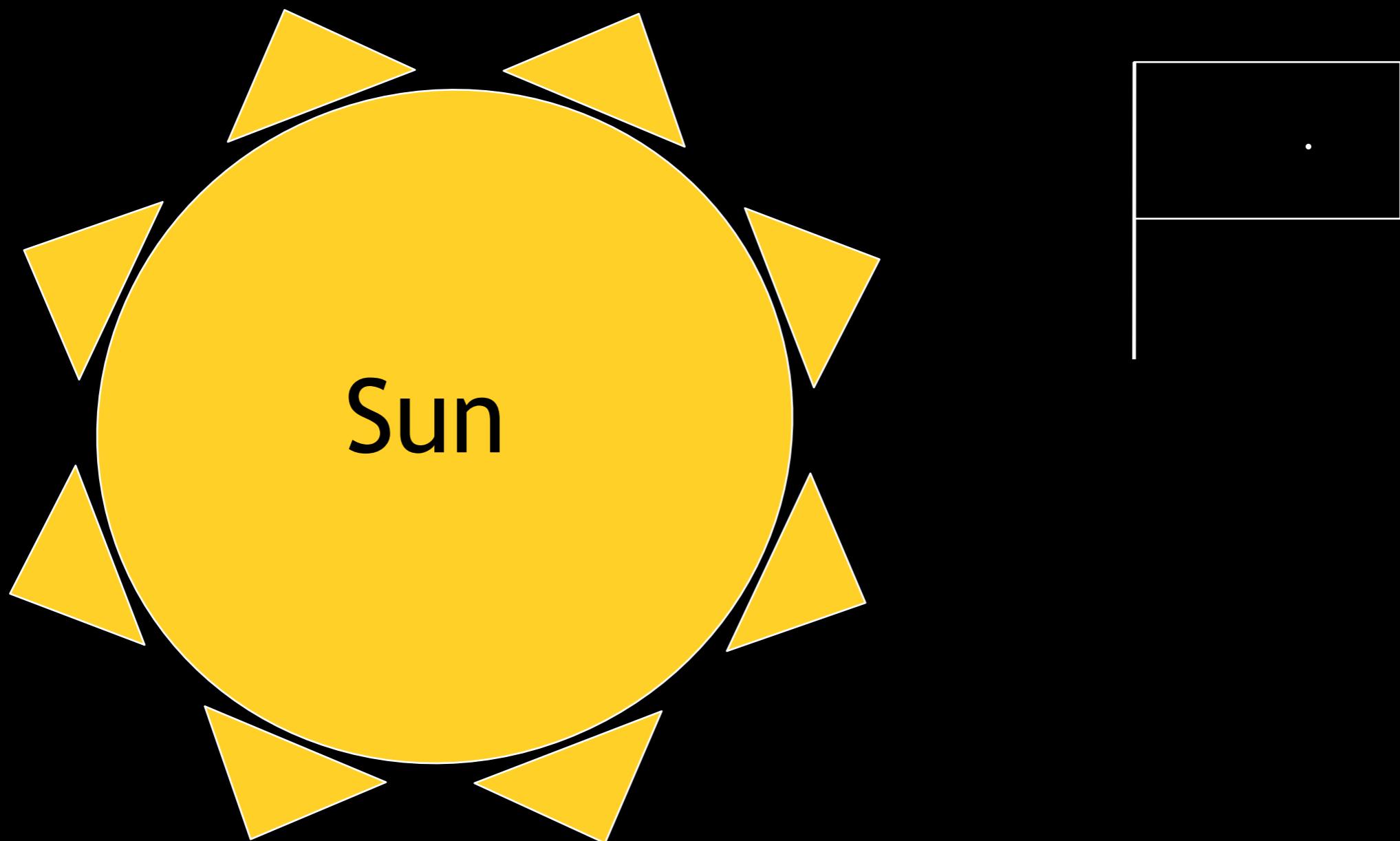
Jupiter:  
18.5 feet away  
0.04" in size



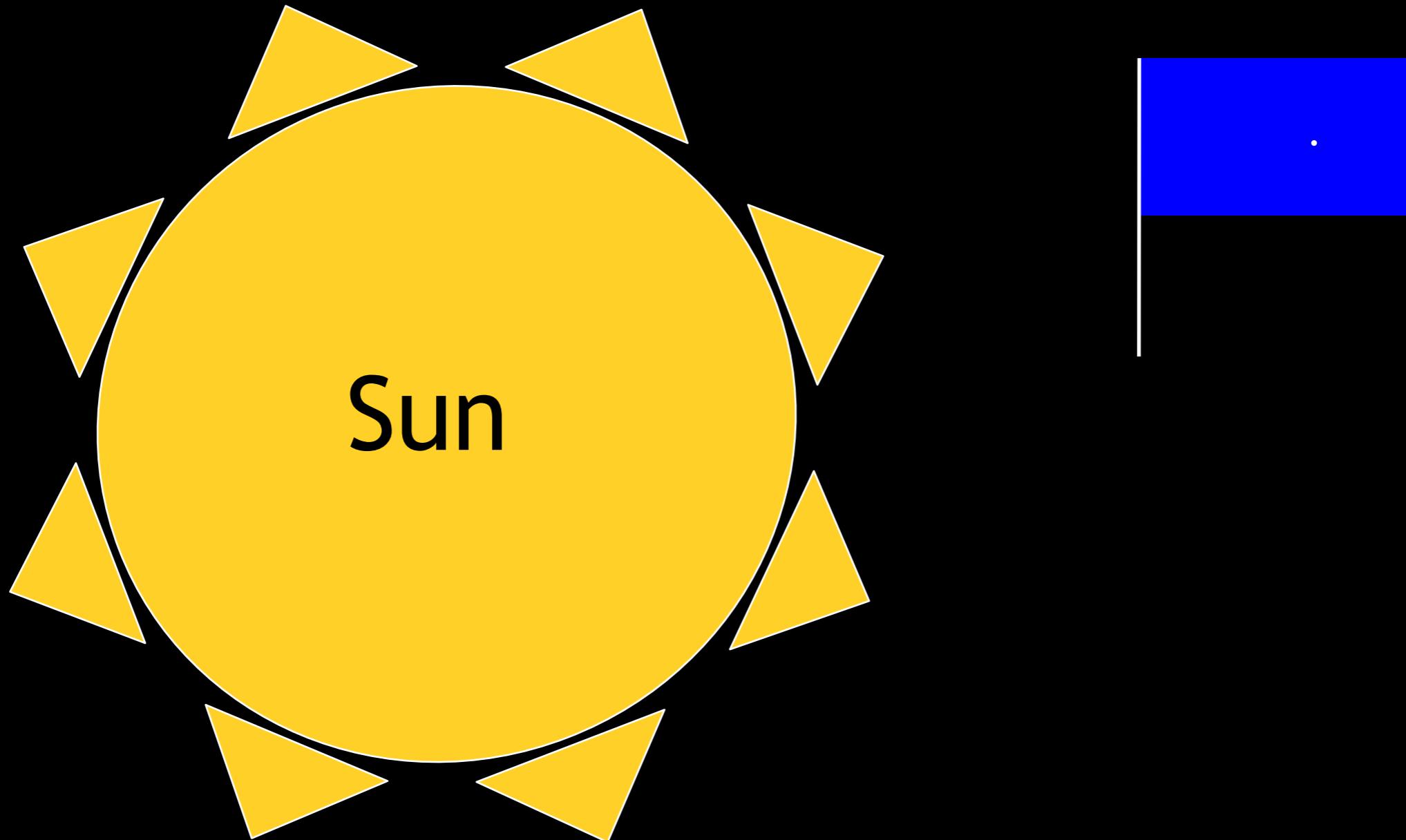
Saturn:  
34 feet away



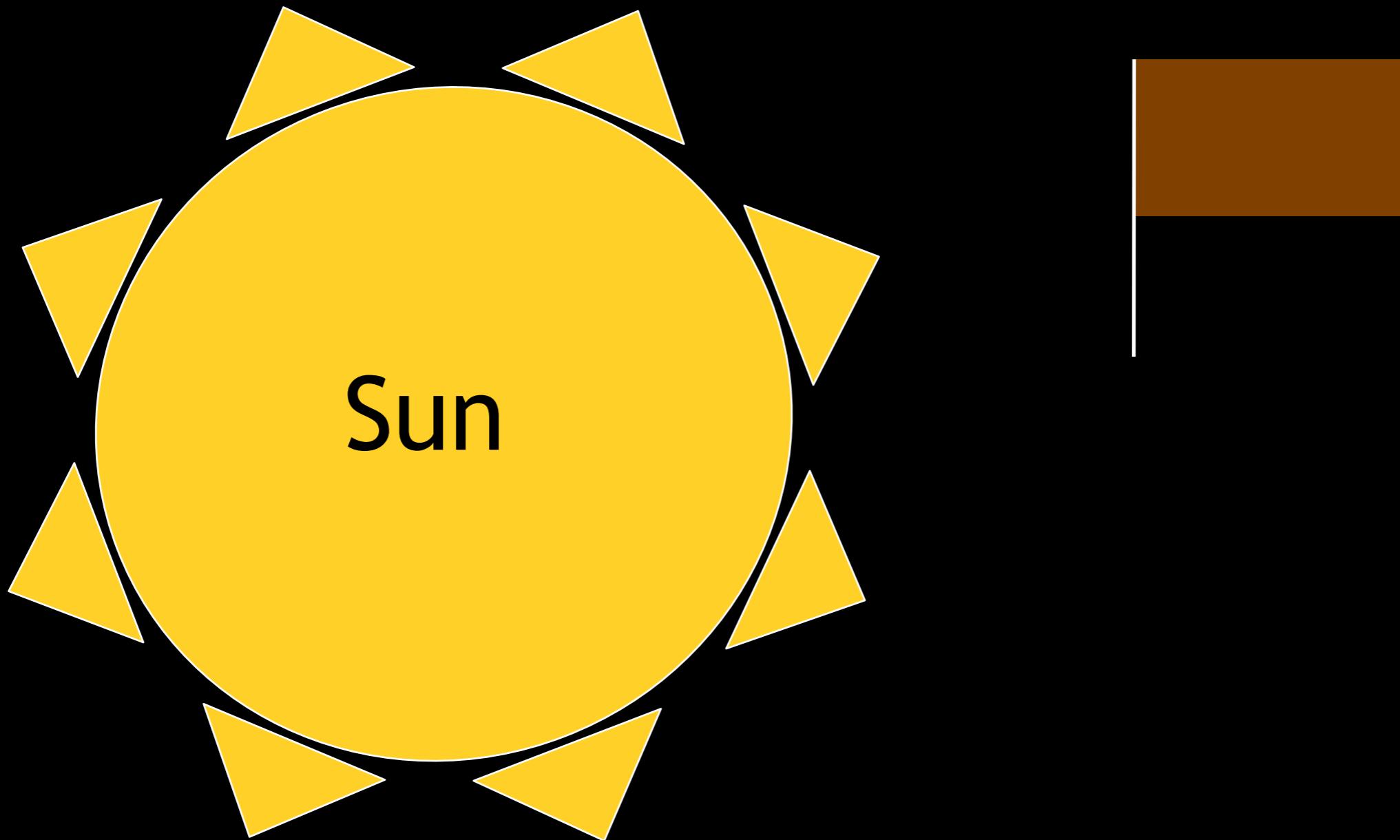
Uranus:  
69 feet away



Neptune:  
108 feet away



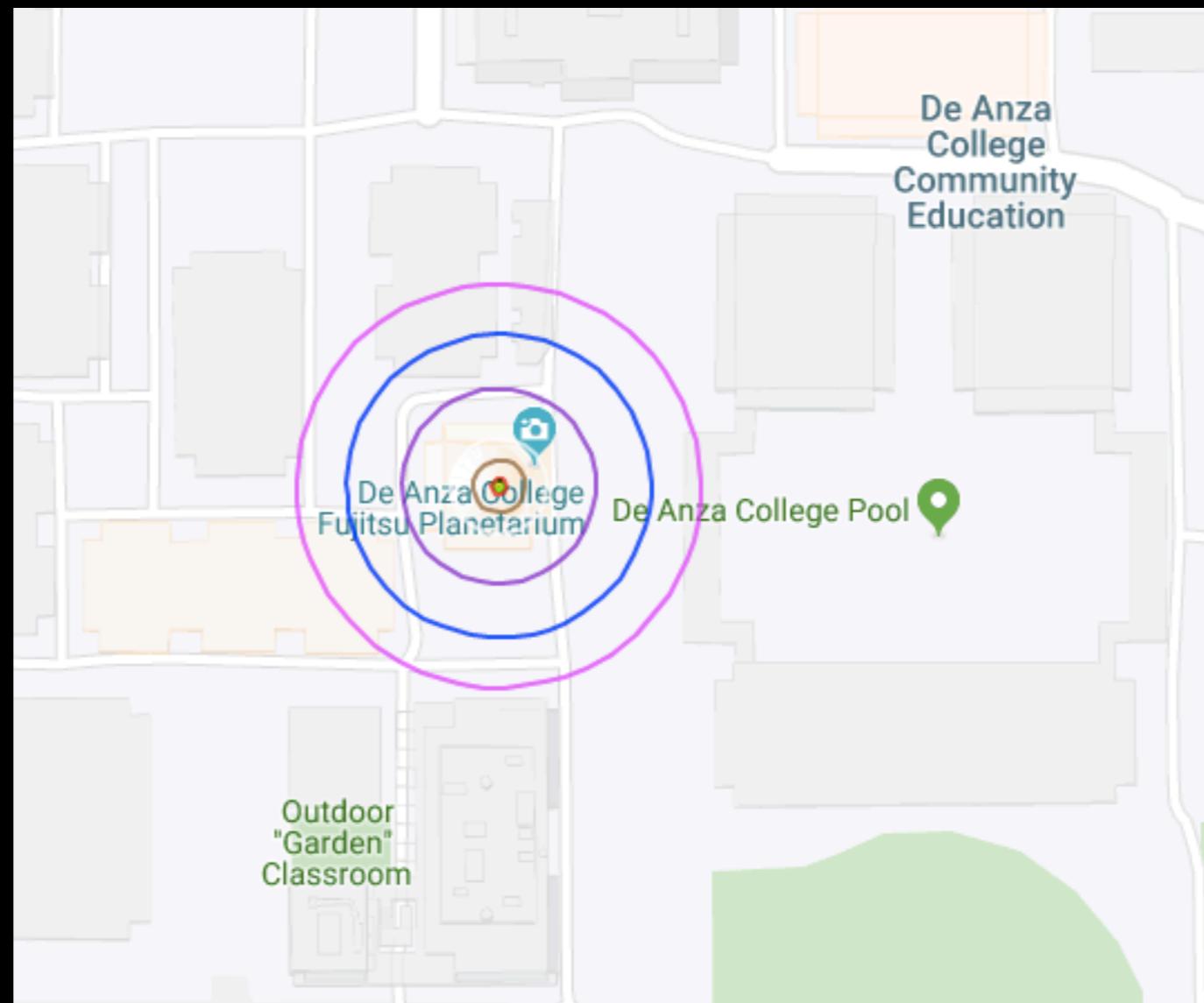
Pluto:  
141 feet away



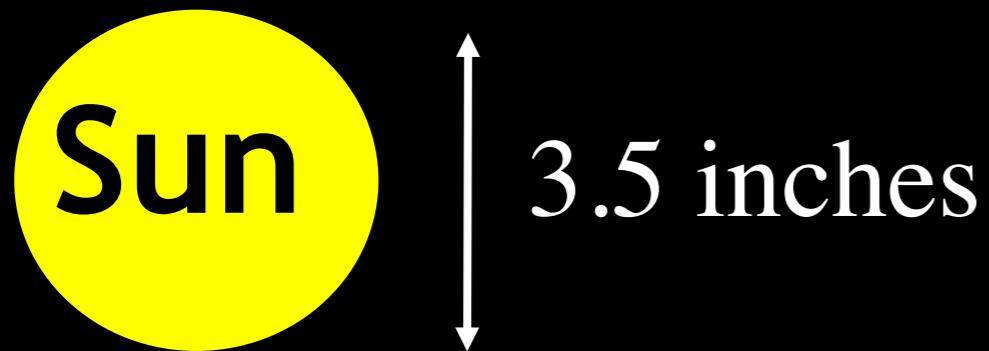
Q: If the SUN is ~ one cm wide, can we fit a scale model of the solar system in this planetarium?

A)YES!

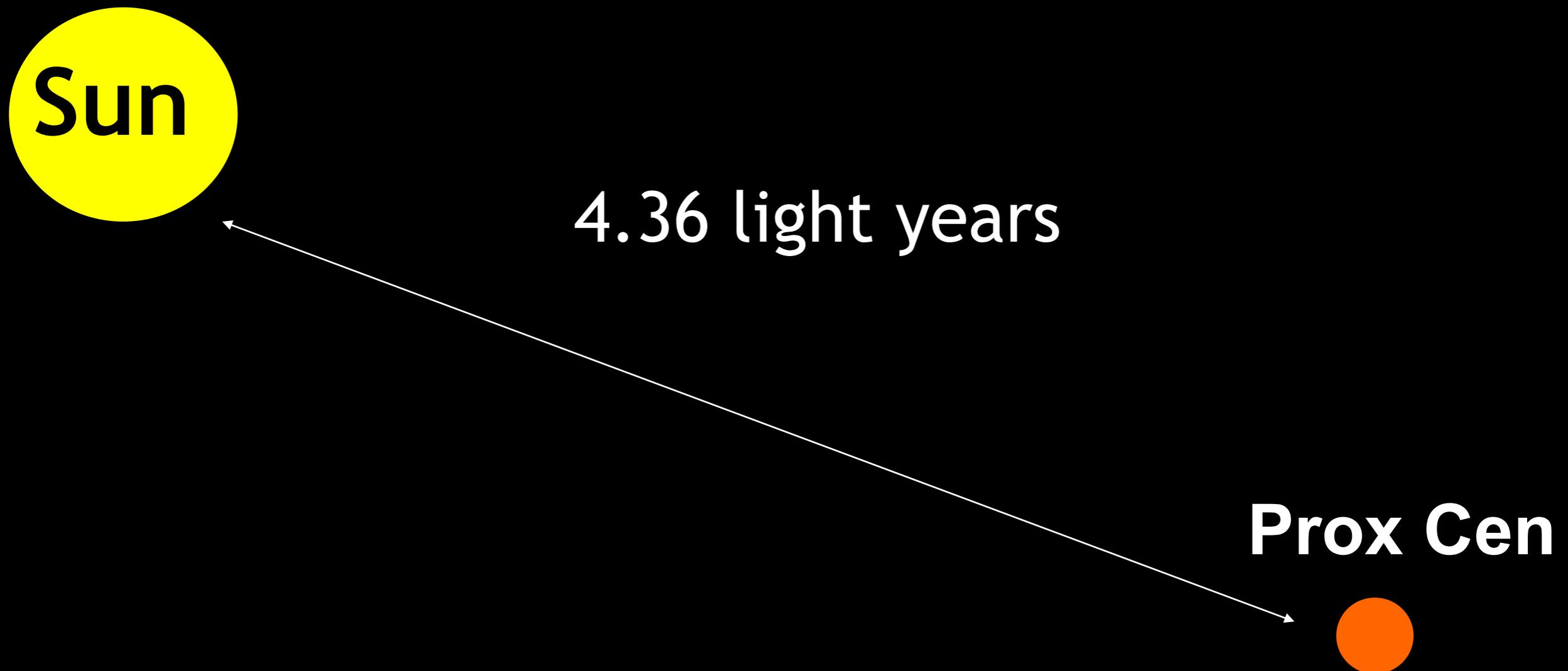
B)NO!



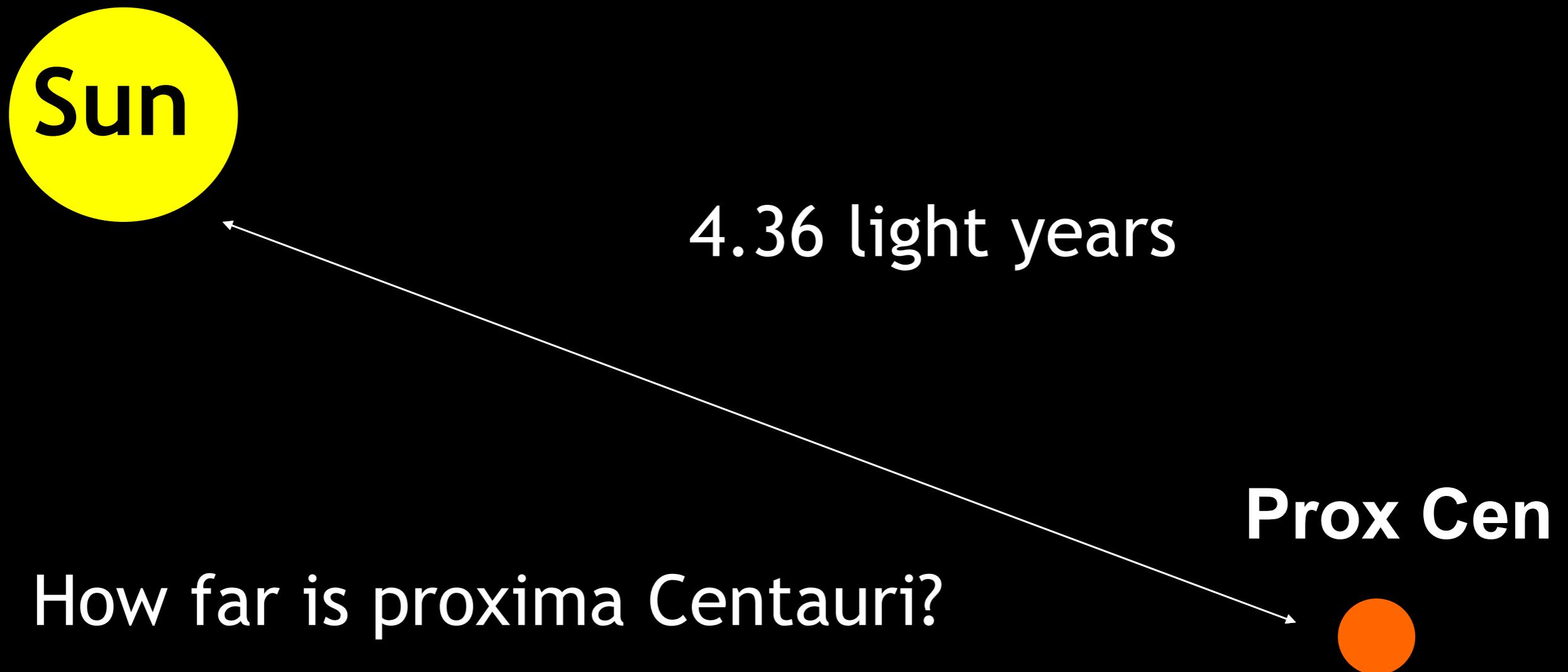
# Scale of our Stellar Neighborhood



# Scale of our Stellar Neighborhood



# Scale of our Stellar Neighborhood



# How far is Proxima Centauri?



- A) 1200 inches
- B) 1200 feet
- C) 1200 yards
- D) 1200 miles

Prox Cen



# Scale of our Stellar Neighborhood



**Sun**

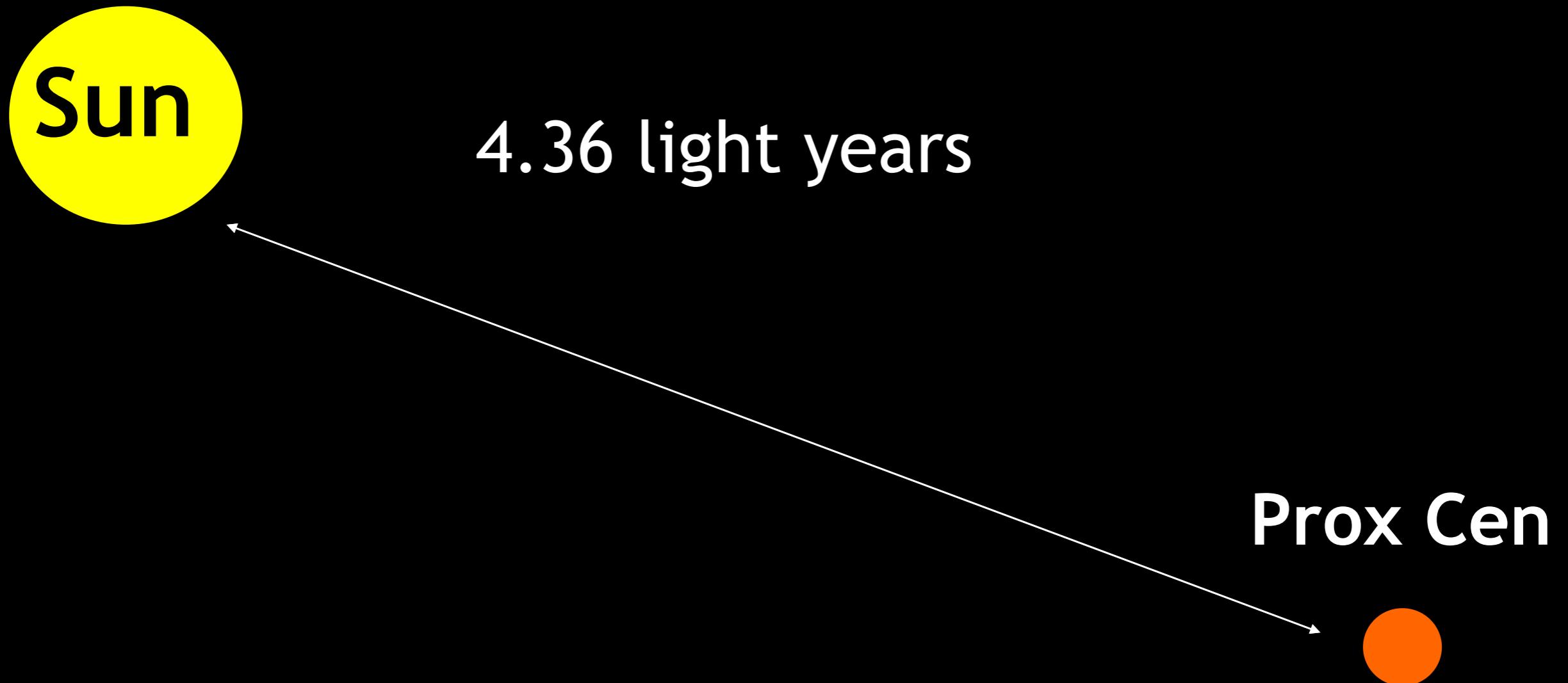
4.36 light years

On this scale  
~1220 miles

**Prox Cen**



# Scale of the Stellar Neighborhood - again

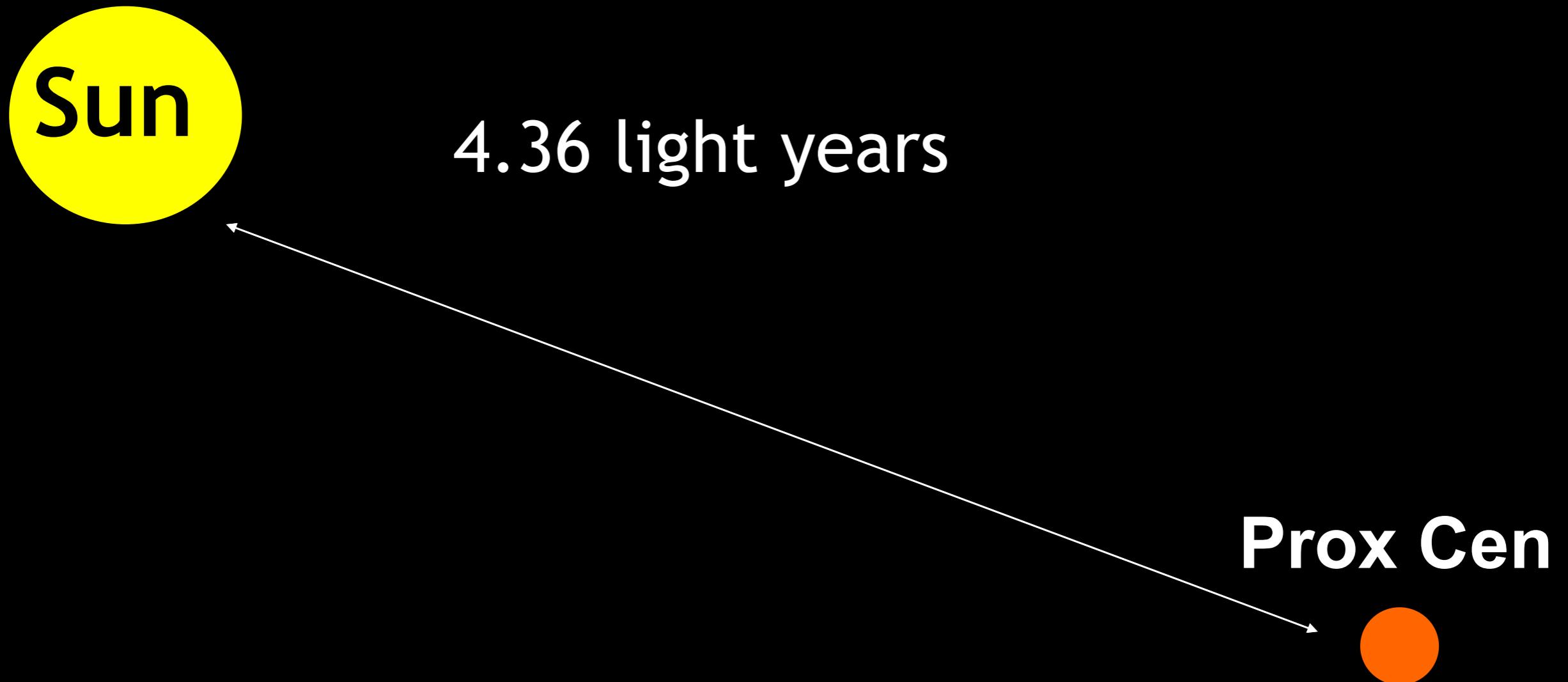


# Scale of the Stellar Neighborhood - One more time



Width of my hair = 0.0024 inches

# Scale of the Stellar Neighborhood - One more time



# Scale of the Stellar Neighborhood - One more time

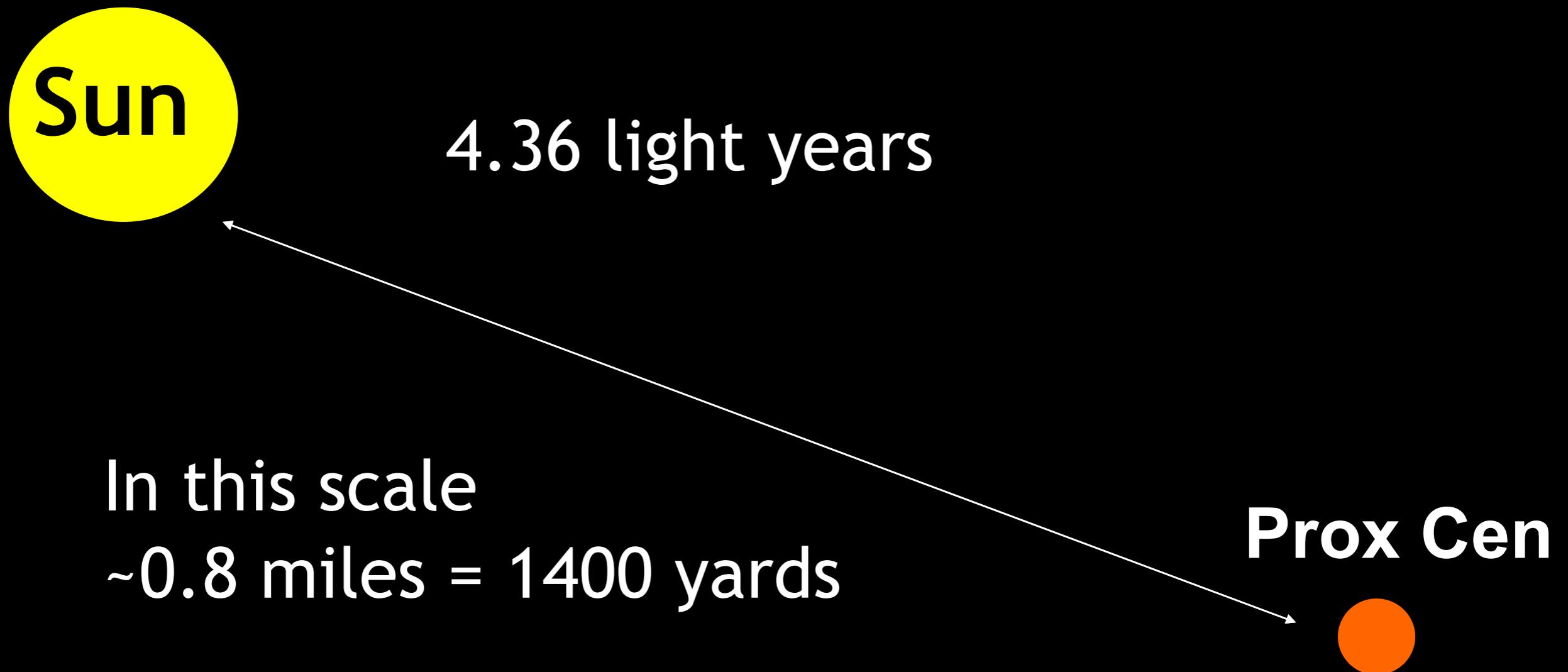


4.36 light years

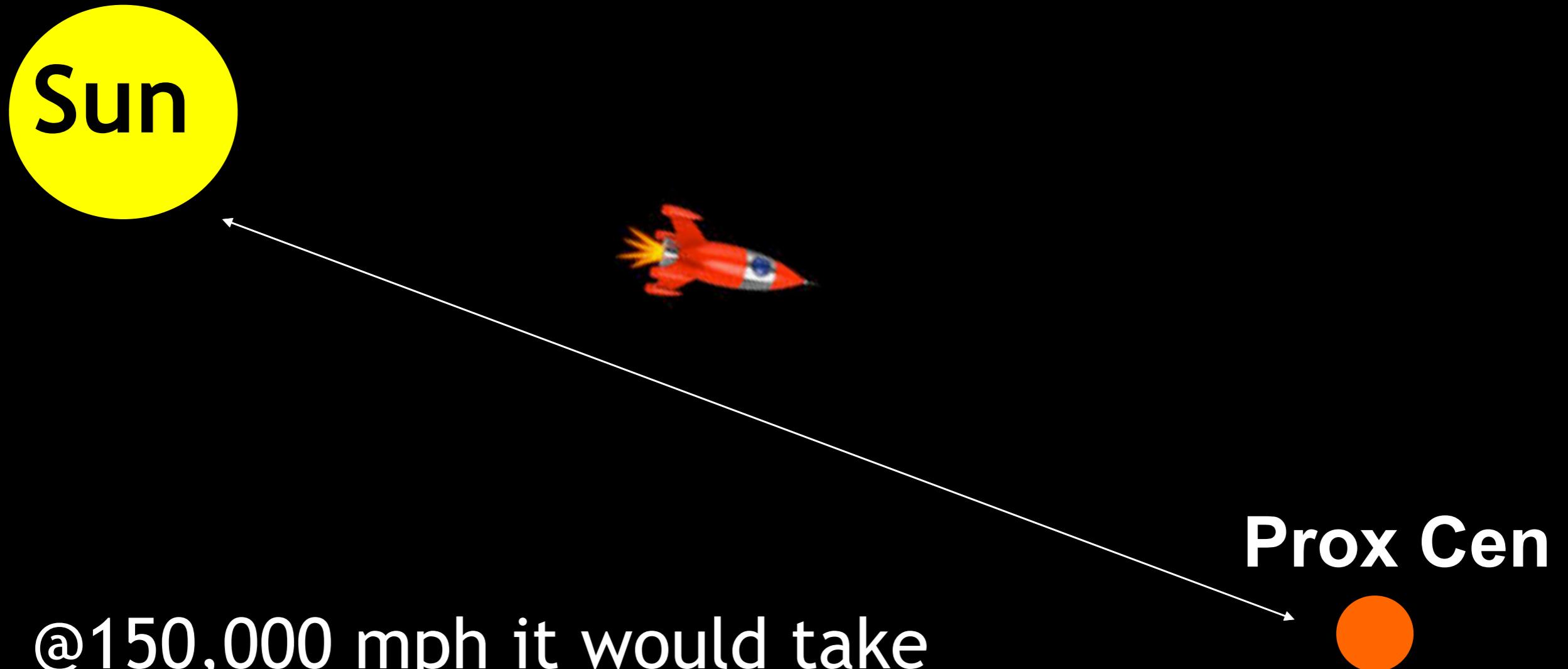
- A) 1 inch
- B) 1 foot
- C) 1 yard
- D) 1 mile



# Scale of the Stellar Neighborhood – One more time

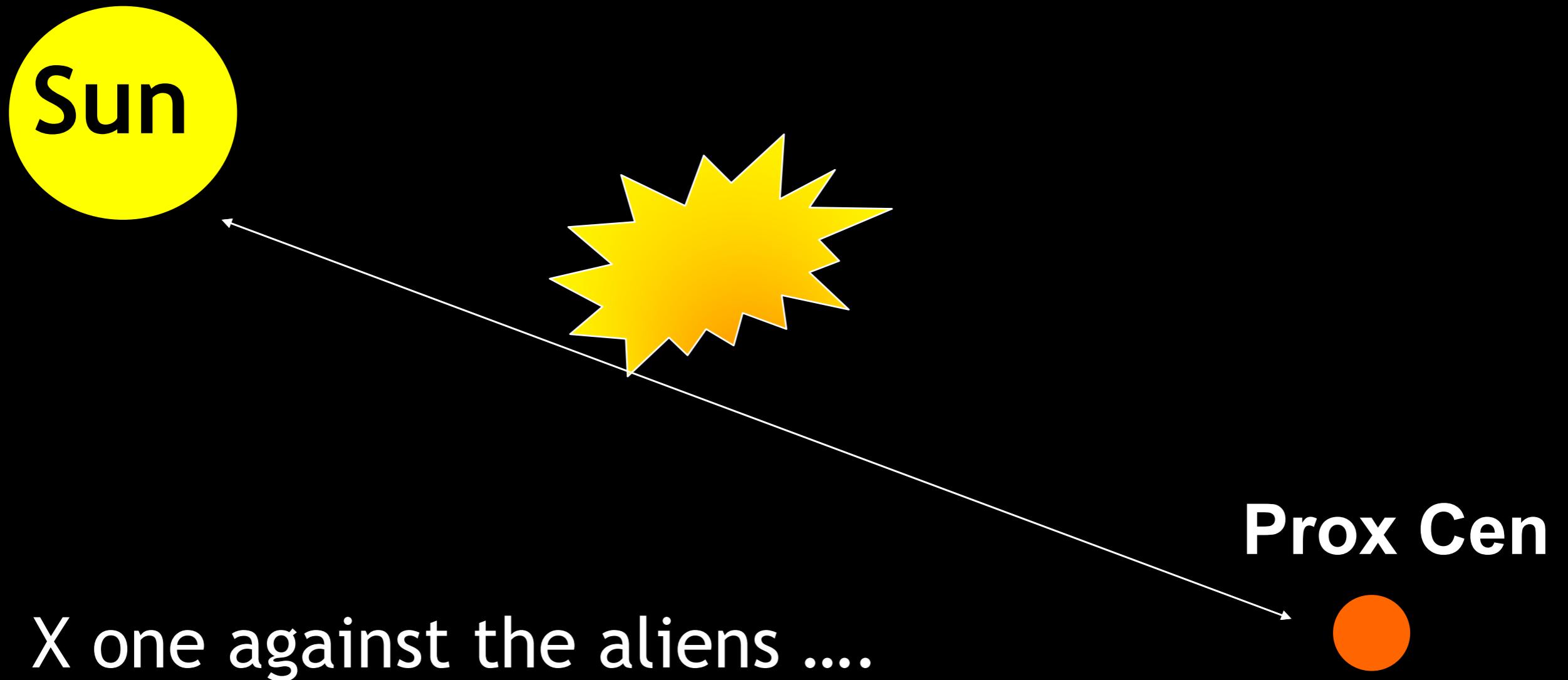


Conclusion: the distances between stars  
are **HUGE** compared to their size!!!!

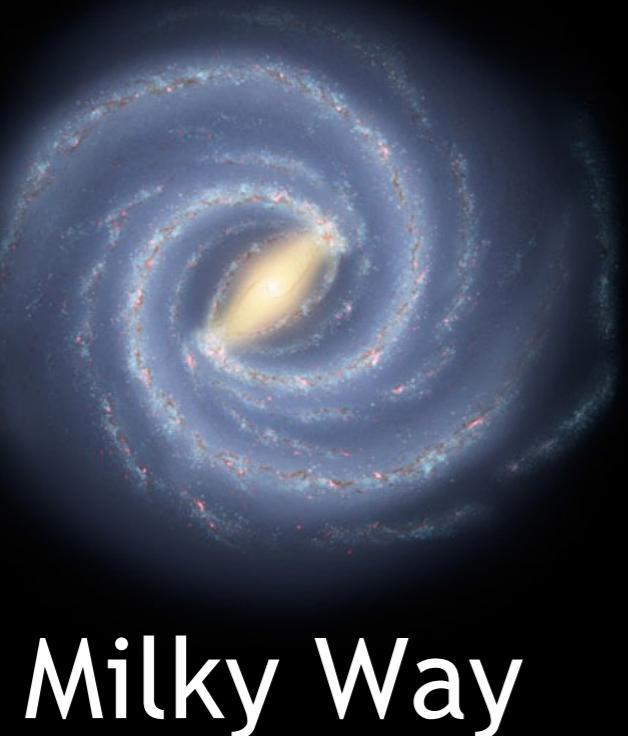


@150,000 mph it would take  
~19,000 years to get there!!!

Conclusion: the distances between stars  
are **HUGE** compared to their size!!!!



# Scale of the Galactic Neighborhood



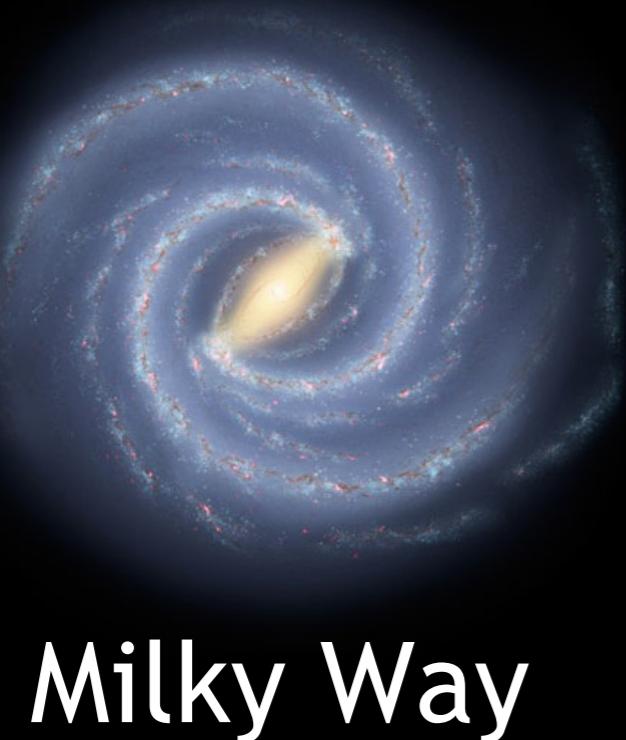
7 inches



Andromeda



# Scale of the Galactic Neighborhood

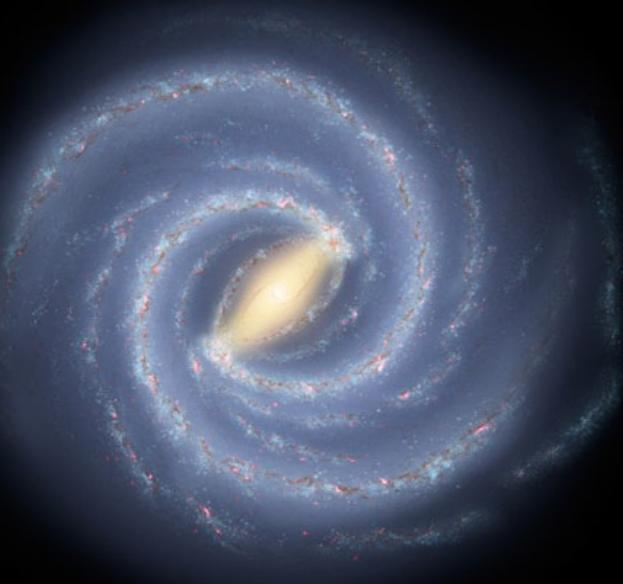


7 inches =  
100000 light years

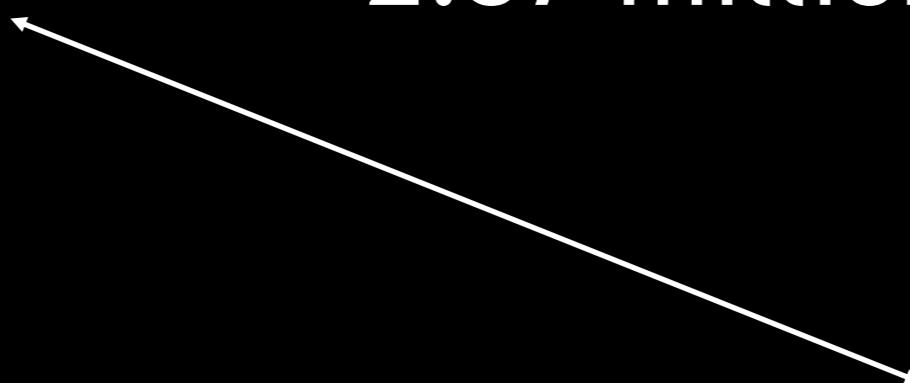
Andromeda



# Scale of the Galactic Neighborhood



2.57 million light years



# Scale of the Galactic Neighborhood



2.57 million light years

178 inches = 14 feet



# Scale of the Galactic Neighborhood



# To summarize so far

We cannot fit a 1 cm Sun scaled version of the Solar System in this planetarium

The distances between the stars are immense compared to the diameter of the star

The distances between the galaxies are not as large compared to their size