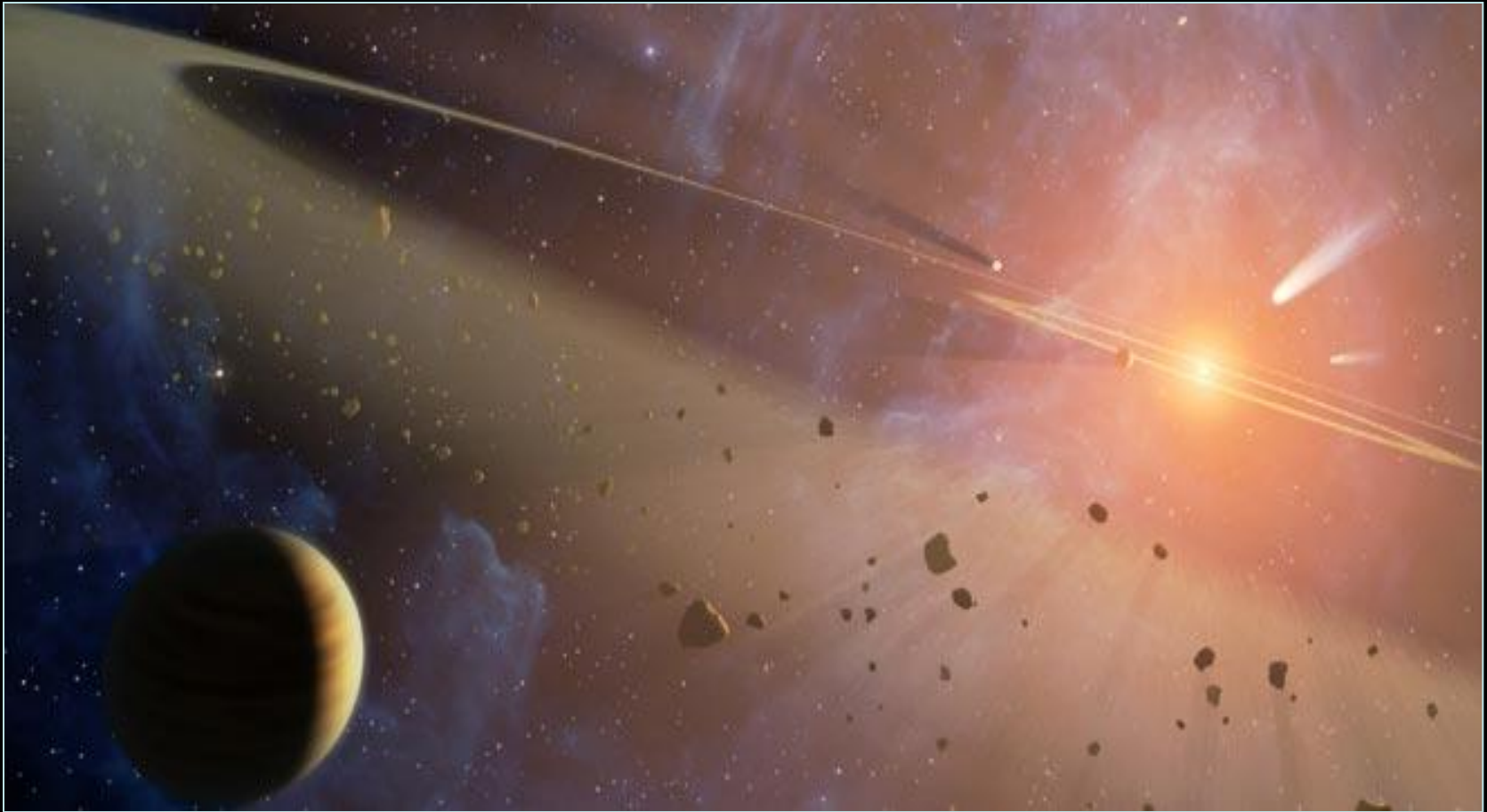


Journey to the Stars

A Fascinating Trip through the Universe



Milwaukee Public
MUSEUM

Robert Bonadurer
Director, Planetarium & IMAX

414.278.6985

Bonadurer@mpm.edu

Daniel M. Soref Planetarium



Biggest & Best in the Midwest



Dome diameter: 74 feet
Capacity: 263 Seats
Attendance: 200,000

Private Shows

- Business Events
- Birthdays
- Social Organizations
- Churches
- Girl & Boy Scouts
- Weddings



Why a Planetarium?



Stargazing



UPCOMING CELESTIAL EVENTS

May 20: Partial Solar Eclipse

June 5: Transit of Venus



**View these events safely
with MPM Eclipse Shades.**

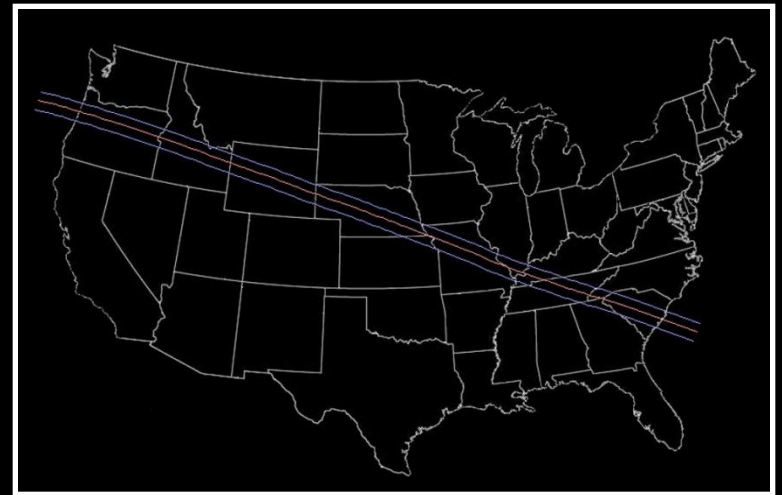
For sale in the Marketplace for \$2.00

Partial Solar Eclipse May 20th





Total Solar Eclipse August 21, 2017





Venus Transit June 5th

Starts at 5:09PM CDT
All in at 5:27pm CDT
SUNSET is 8:26PM CDT



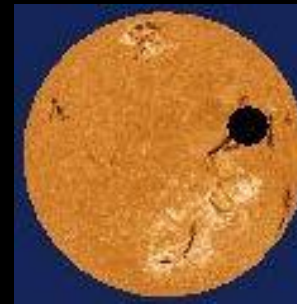
5:15PM CDT



6:15PM CDT



7:15PM CDT



8:15PM CDT

Greatest at 8:29PM
All Done 11:49PM
6 hours 40 minutes

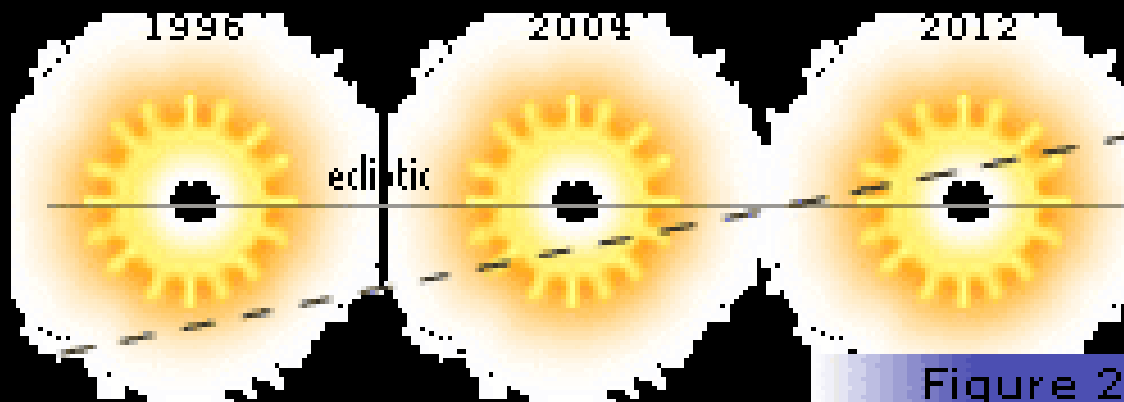
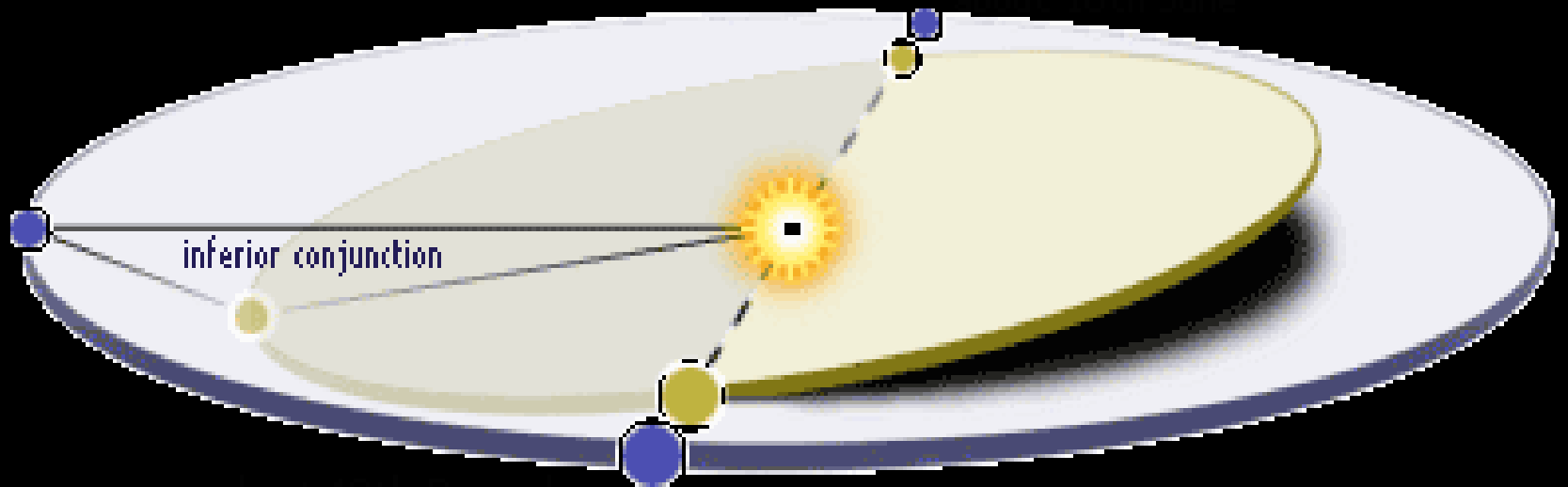
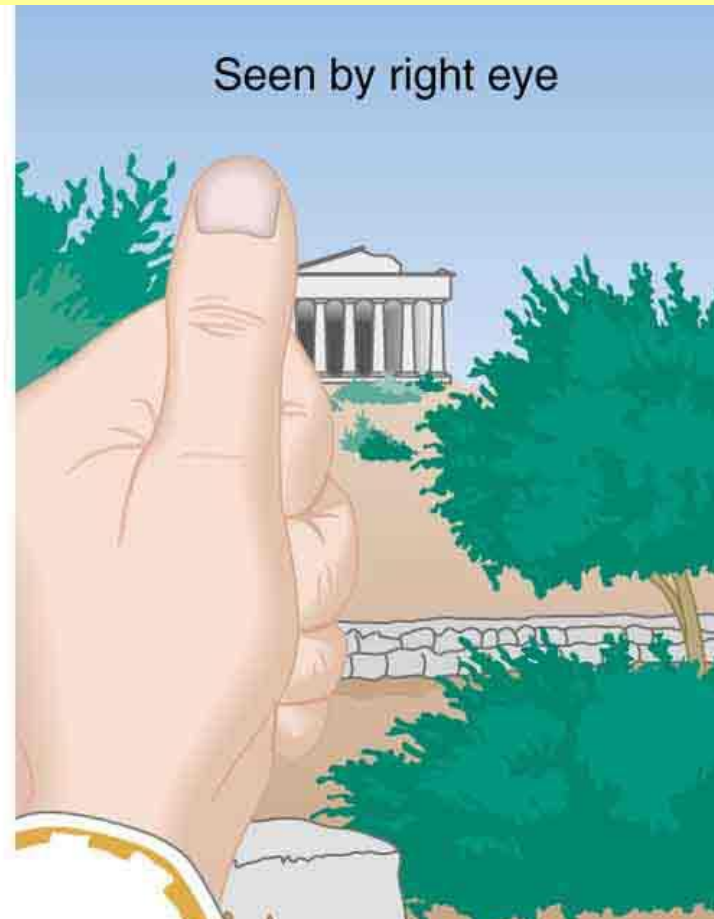
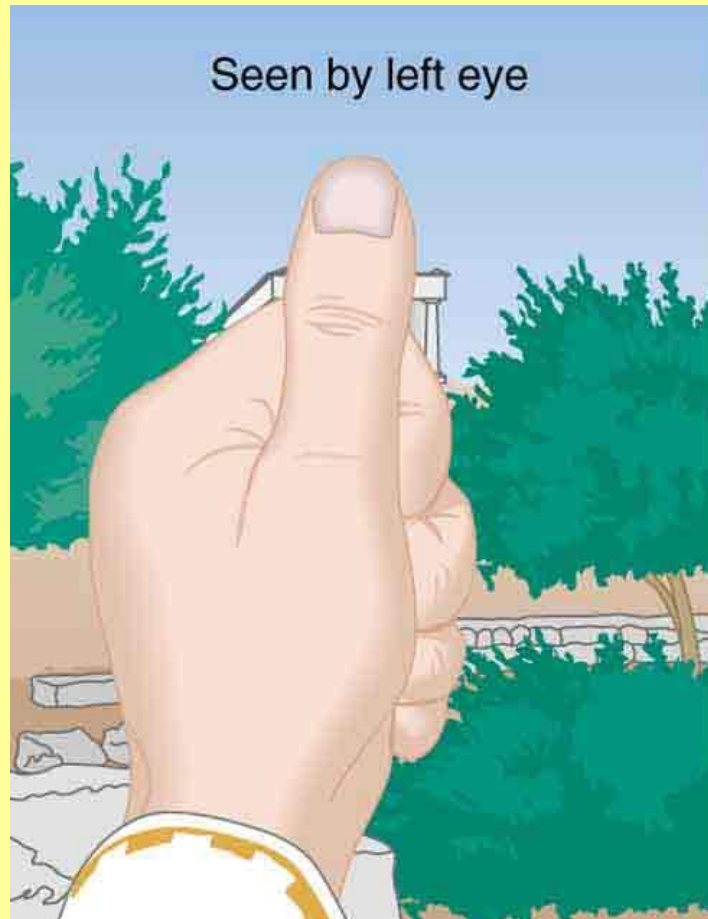


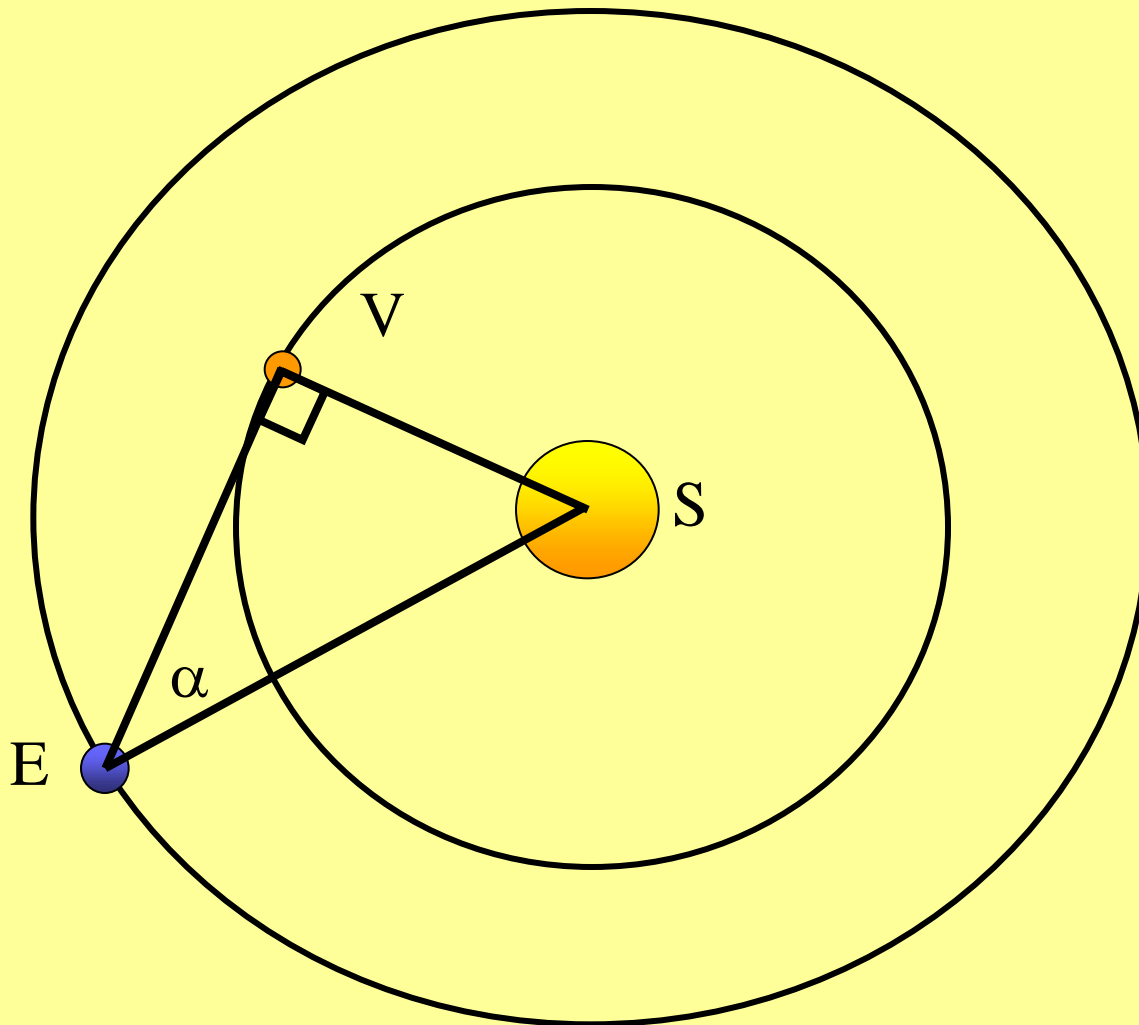
Figure 2

Parallax



How to calculate the AU

Step 1: Venus at Greatest Elongation



$$VS / ES = \sin(\alpha)$$

$$\alpha \sim 46.054 \text{ deg}$$

$$VS / 1 \text{ AU} = \sin(\alpha)$$

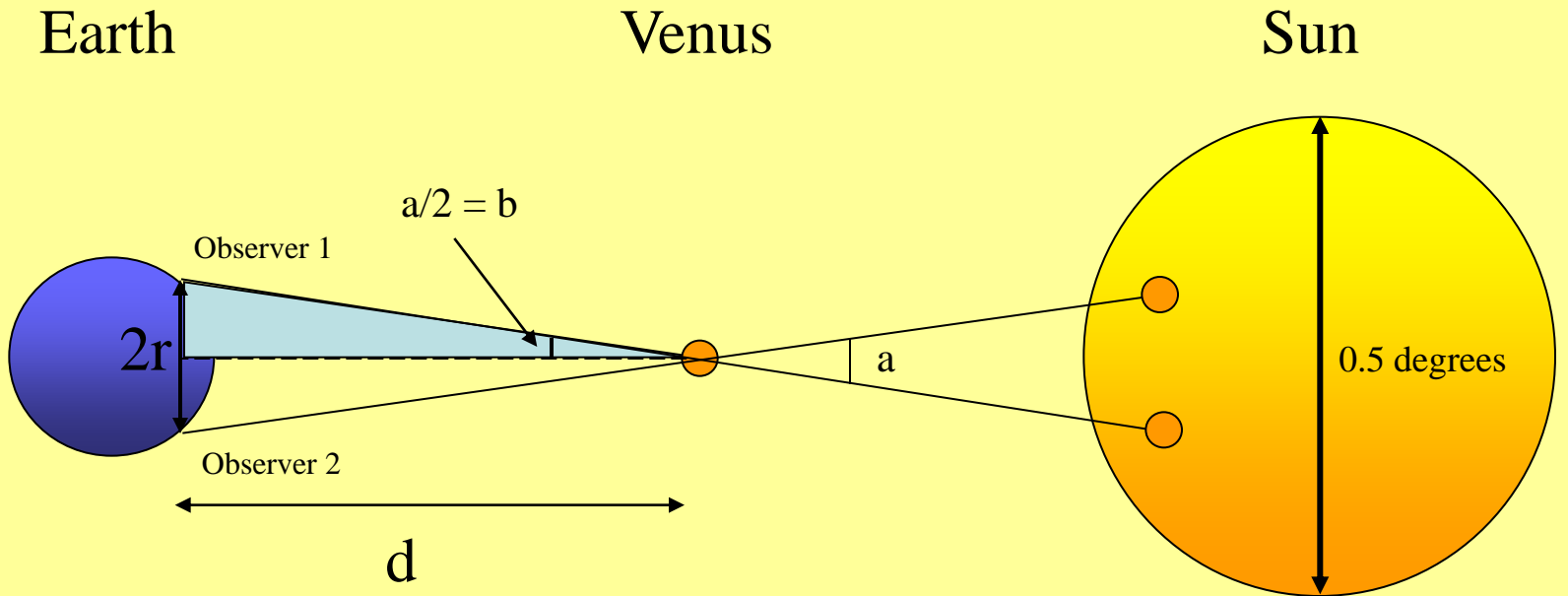
$$VS = 0.72 \text{ AU}$$

so...

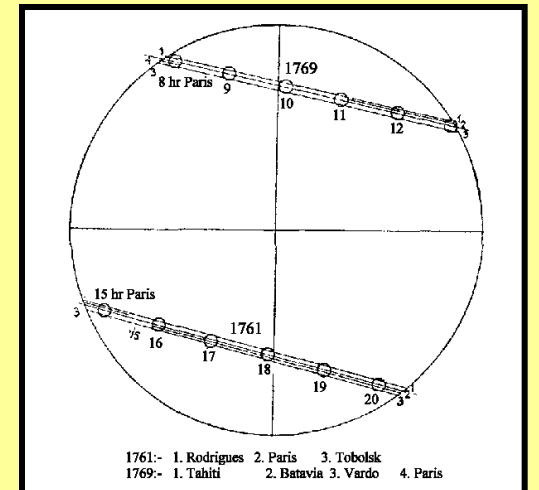
$$\begin{aligned} EV &= 1 - 0.72 \text{ AU} \\ &= 0.28 \text{ AU} \end{aligned}$$

How to calculate the AU

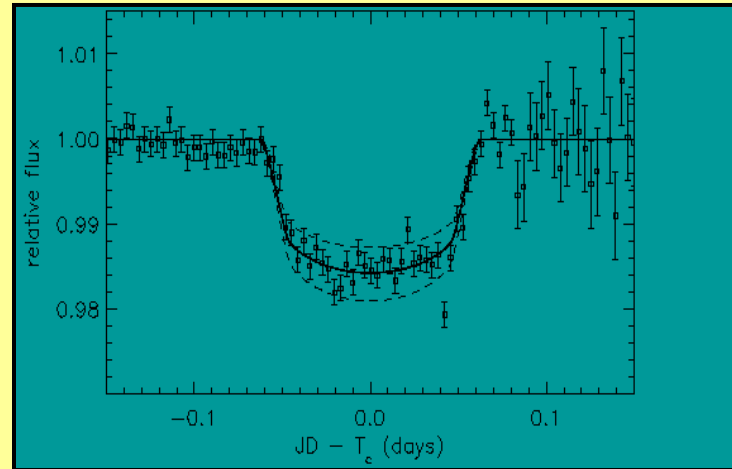
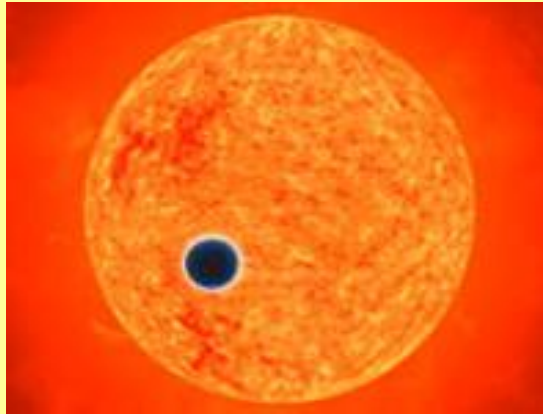
Step 2: Parallax



$$d = r / \tan(b)$$



Searching for Extra-Solar Planets



HD 209458 (mv = +7.7) in Pegasus

709 Planets Confirmed
2,326 Candidates

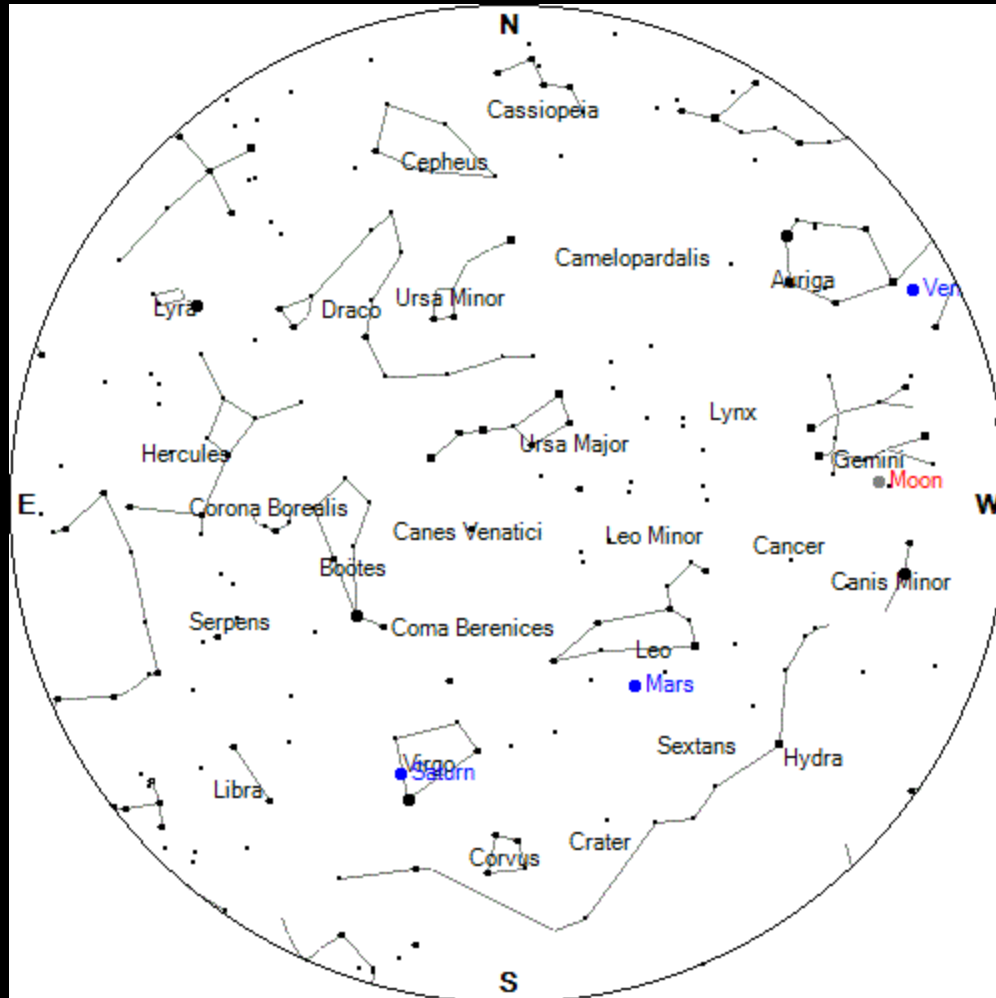


Venus Transits

- December 1631
- December 1639
- June 1761
- June 1769
- December 1874
- December 1882
- June 2004
- June 2012
- December 2117
- December 2125

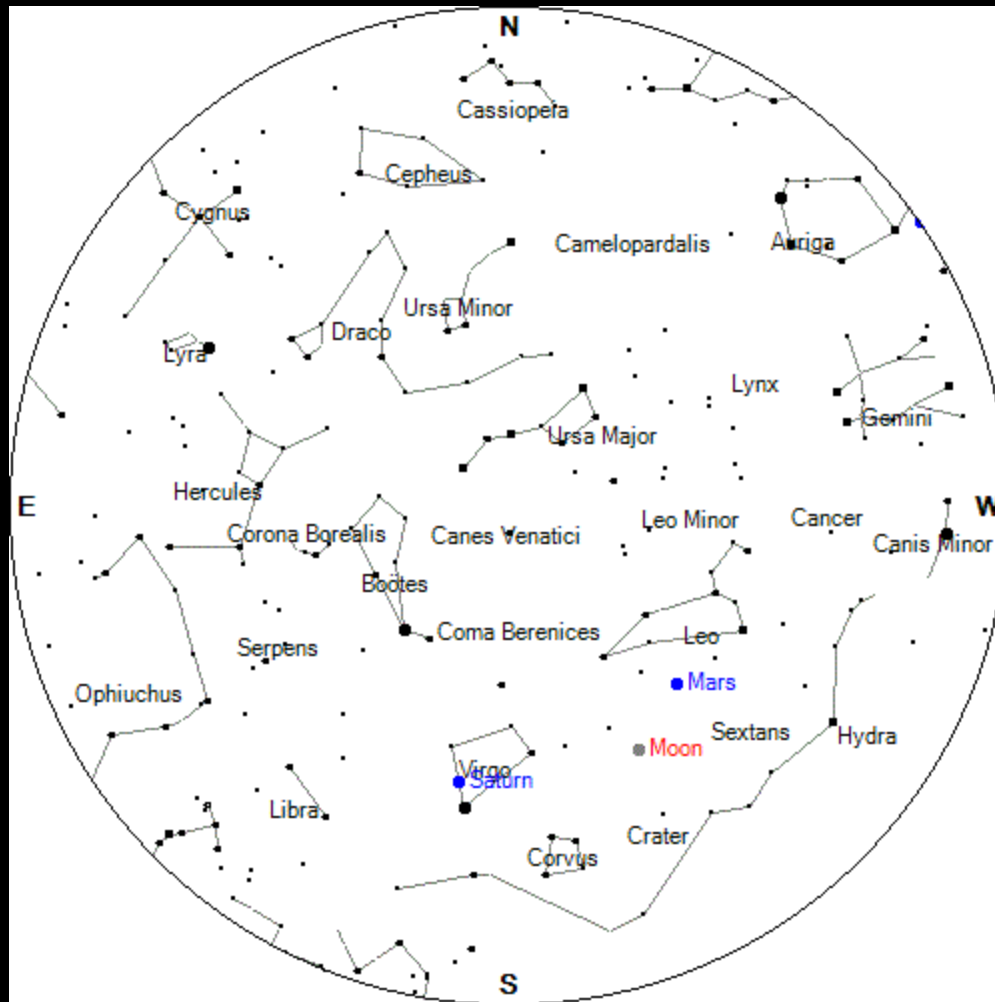
Venus still visible--barely!

Tonight--9:00pm



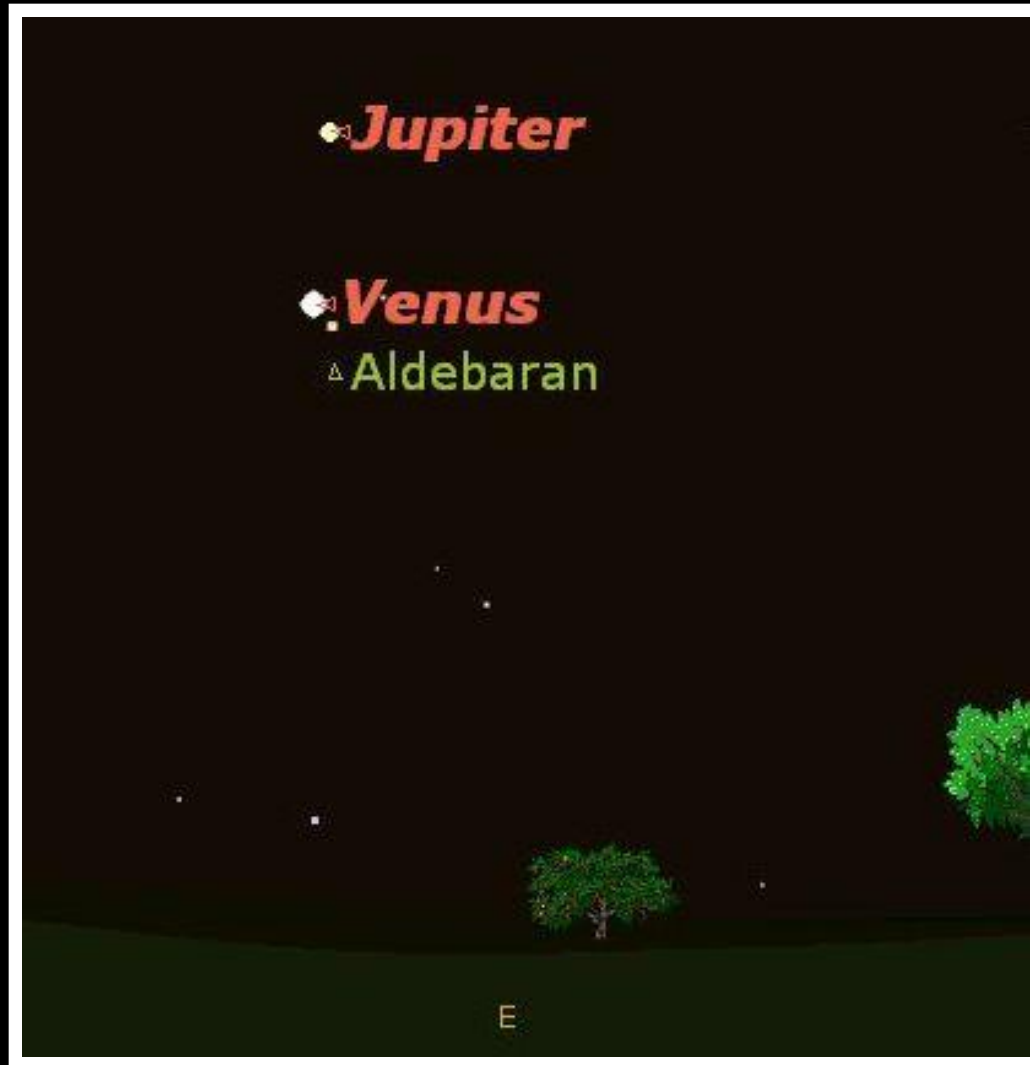
Moon, Mars & Saturn

May 29, 9:15pm

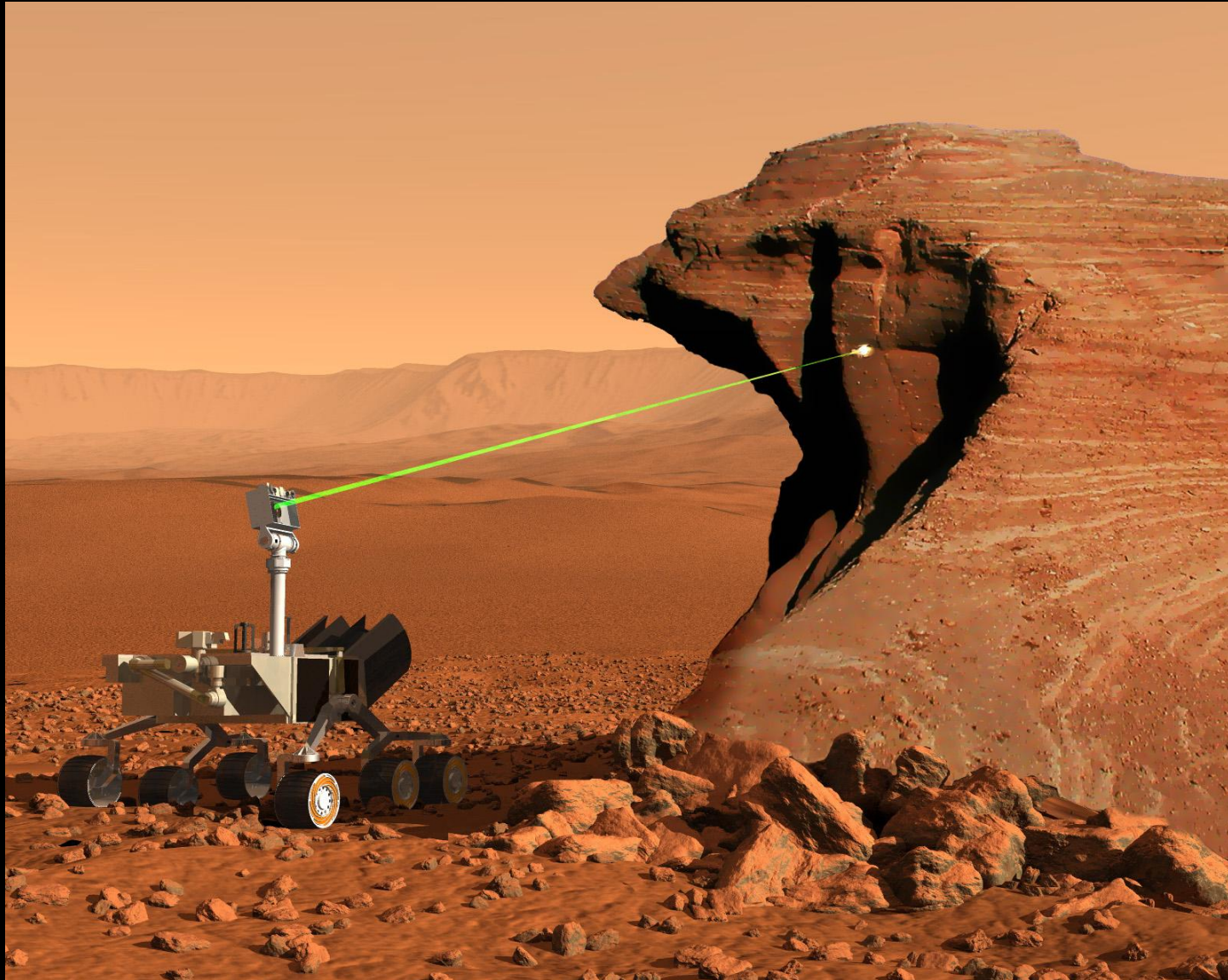


The Two Brightest Planets!

July 9, 4:45am CDT



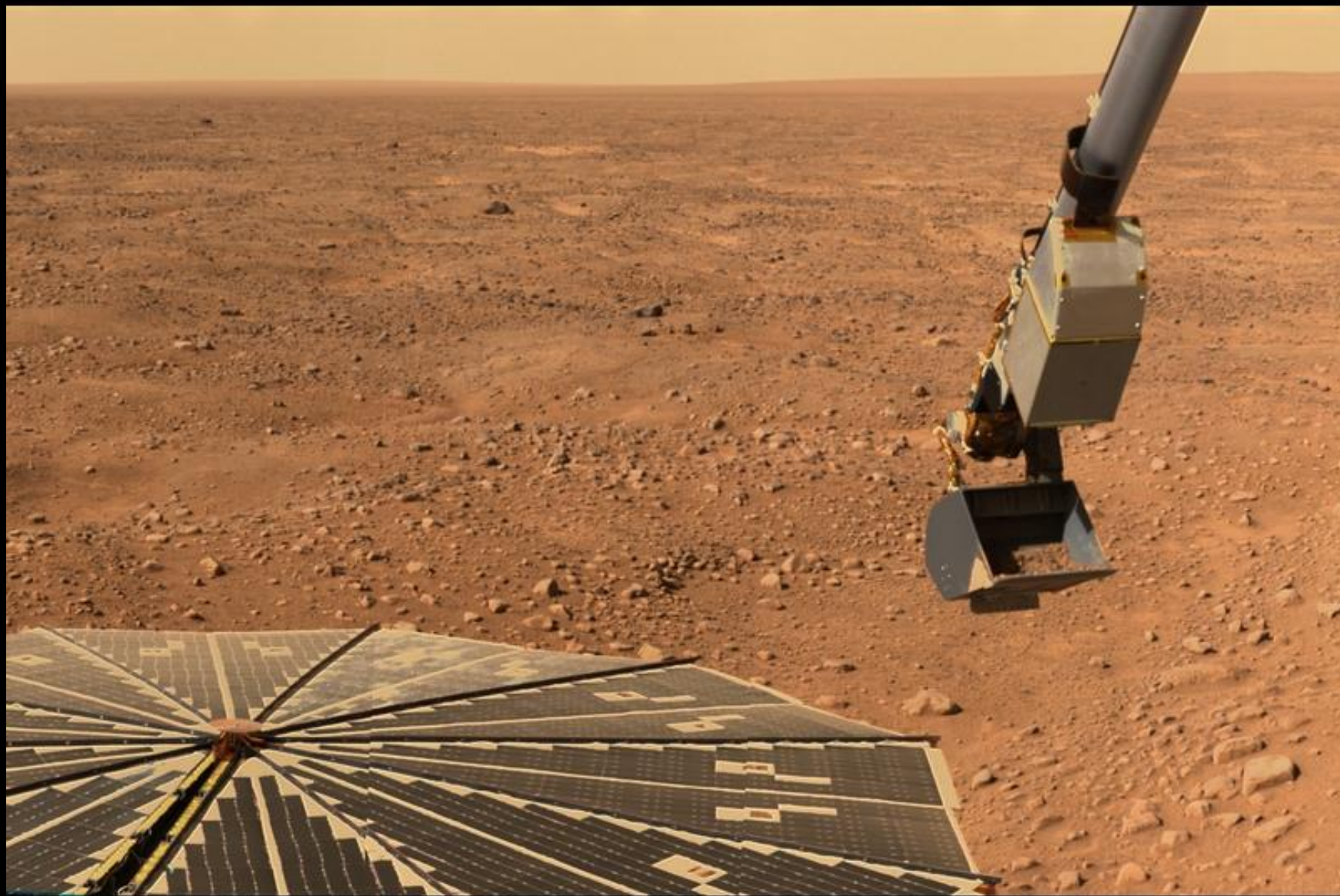
August 6--Let's Land on Mars—Again!

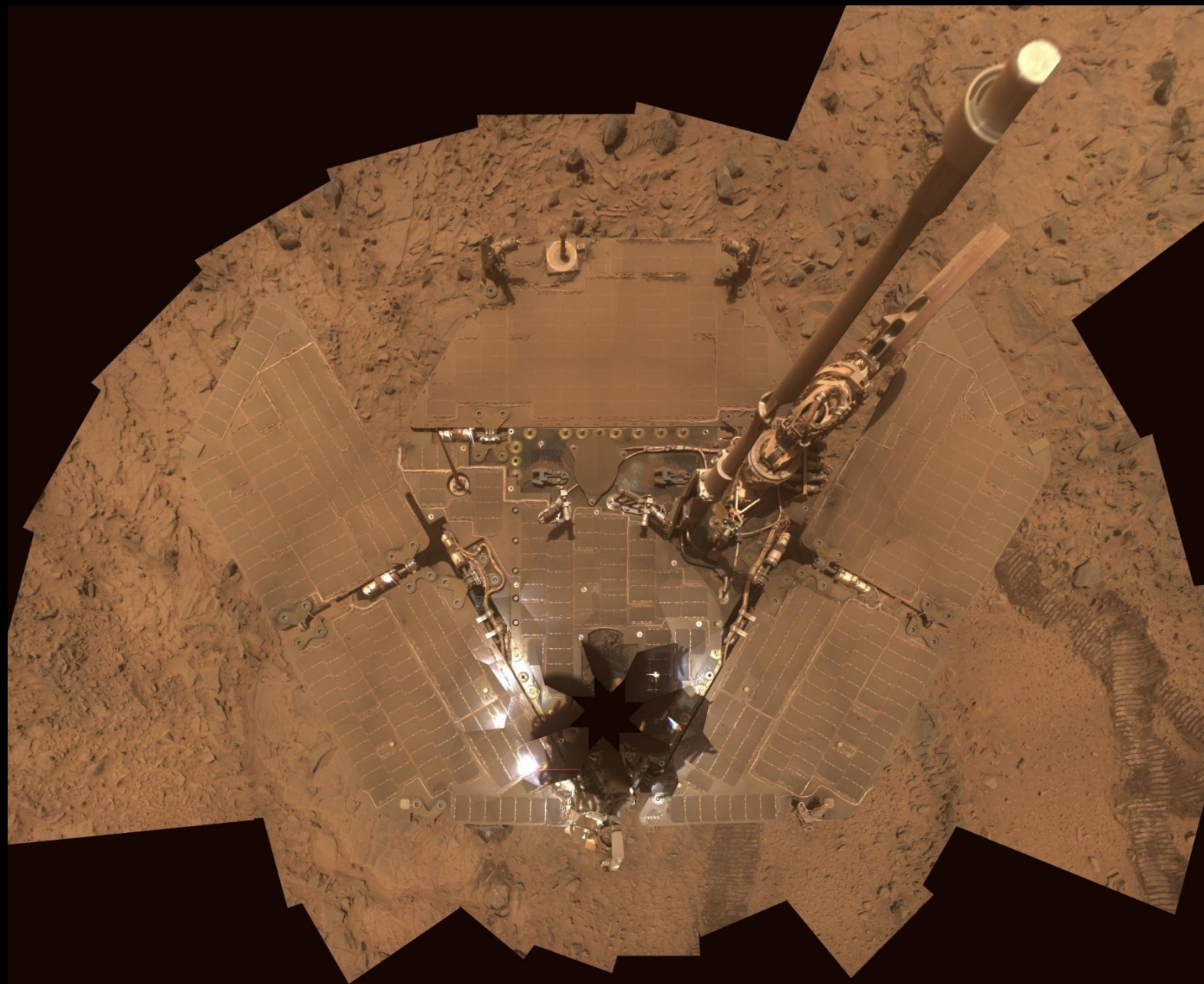






12 year-old Clara Ma
from Sunflower
Elementary Lenexa, KS
named the Rover
Curiosity!





Transit of Earth: November 10, 2084



To Explain Our New Solar System!



Poor Pluto ☹️

It's no longer a planet.



My Very Excellent Mother Just Served Us Nachos!

Explain Big Numbers

A million seconds equals.....?




....12 days.

A billion seconds equals.....?



....32 years!



M13 Globular Cluster
100,000 stars

A dense, spherical cluster of stars, appearing as a bright, hazy patch of light against the dark background of space. The stars are concentrated in the center and become sparser towards the edges.



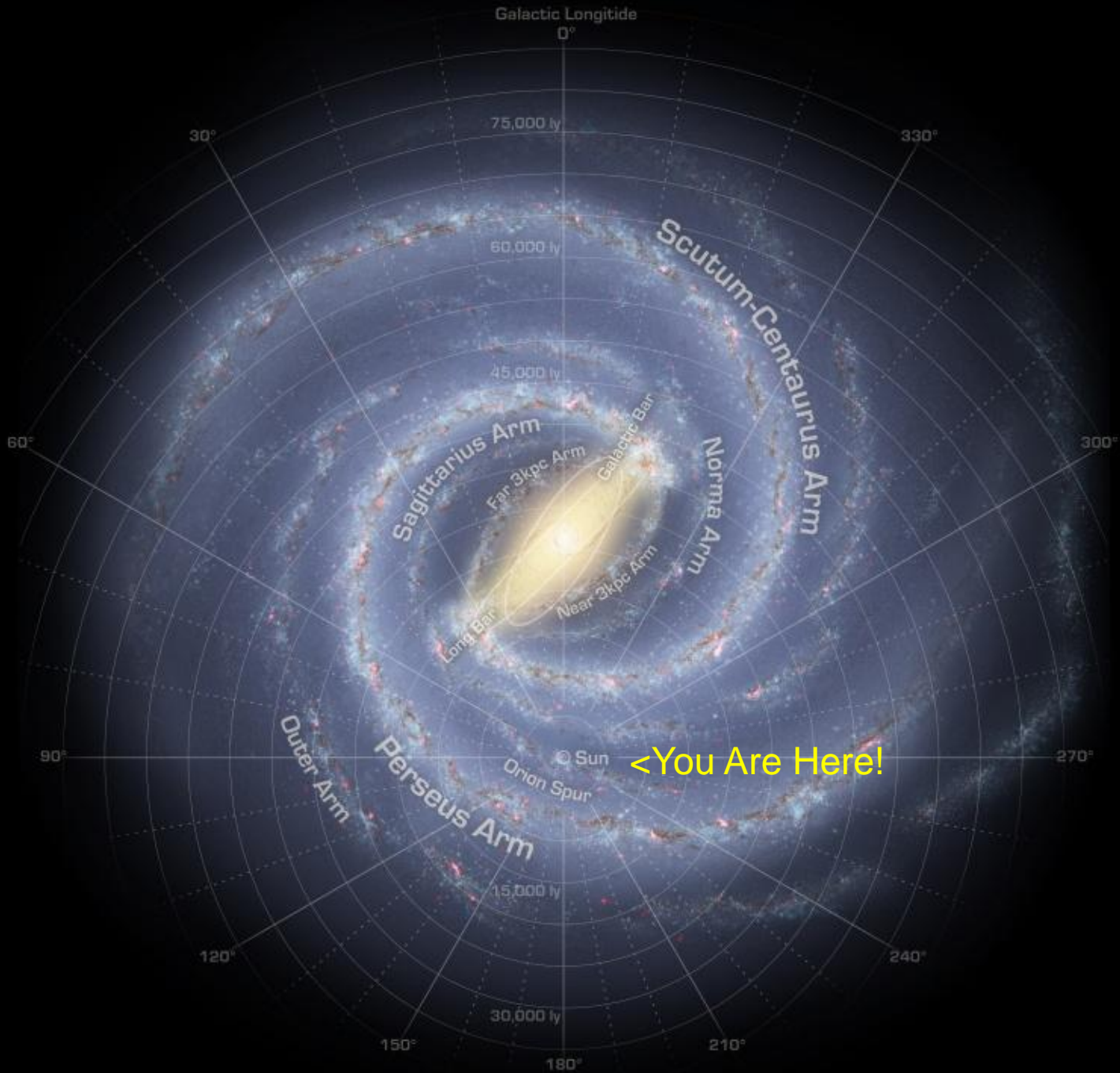
Small Magellanic Cloud
Dwarf Galaxy
100,000,000 stars

A large, irregularly shaped galaxy with a prominent blue glow, indicating the presence of young, hot stars. It has a complex, clumpy structure with many bright spots and a dark, dusty lane running through it.



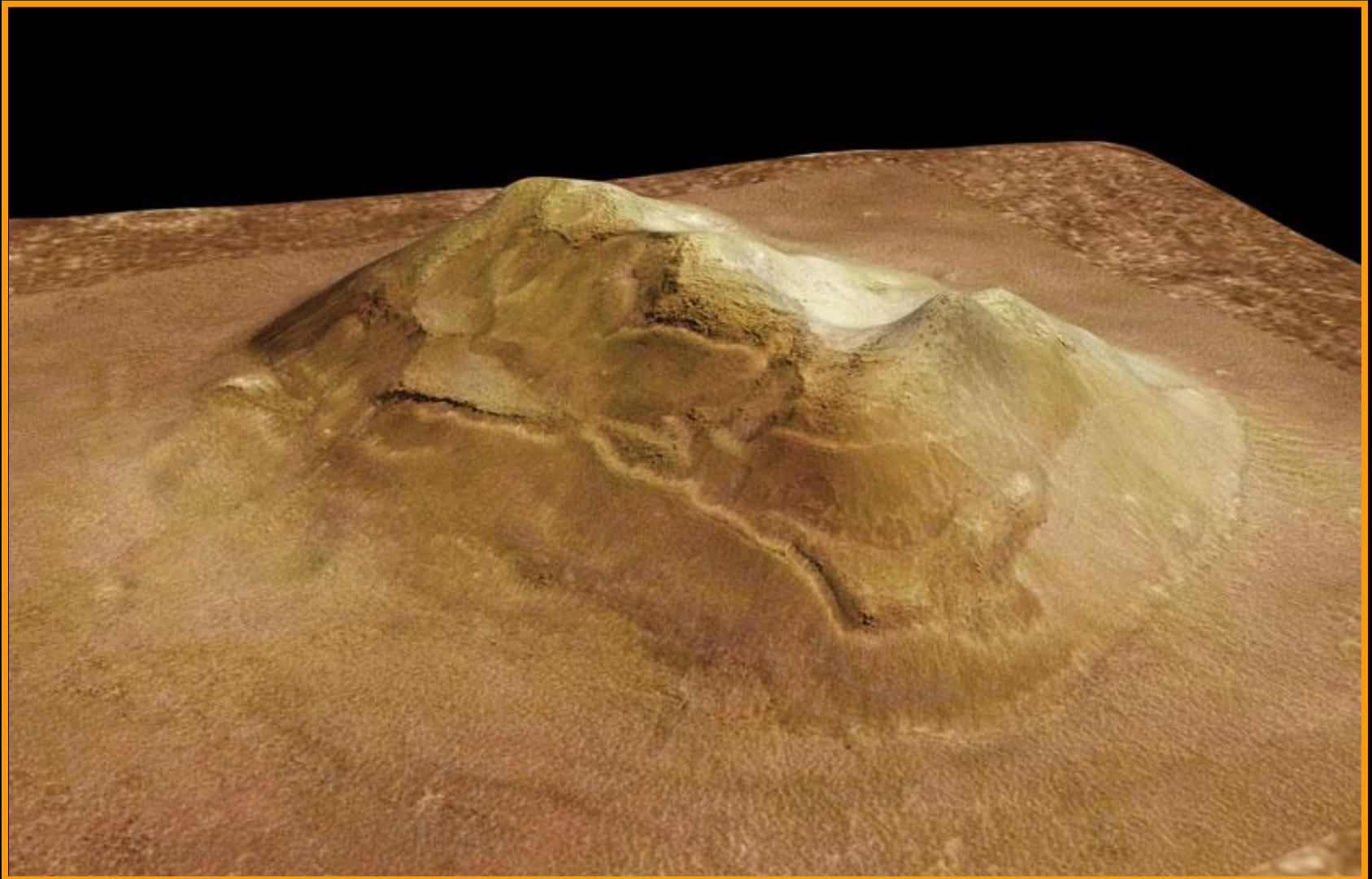
Andromeda Galaxy
300,000,000,000 stars

A large, bright, elliptical galaxy with a distinct spiral structure. The central core is very bright and yellowish-white, surrounded by a dense field of stars and a prominent dust lane. The galaxy is tilted at an angle, showing its three-dimensional structure.

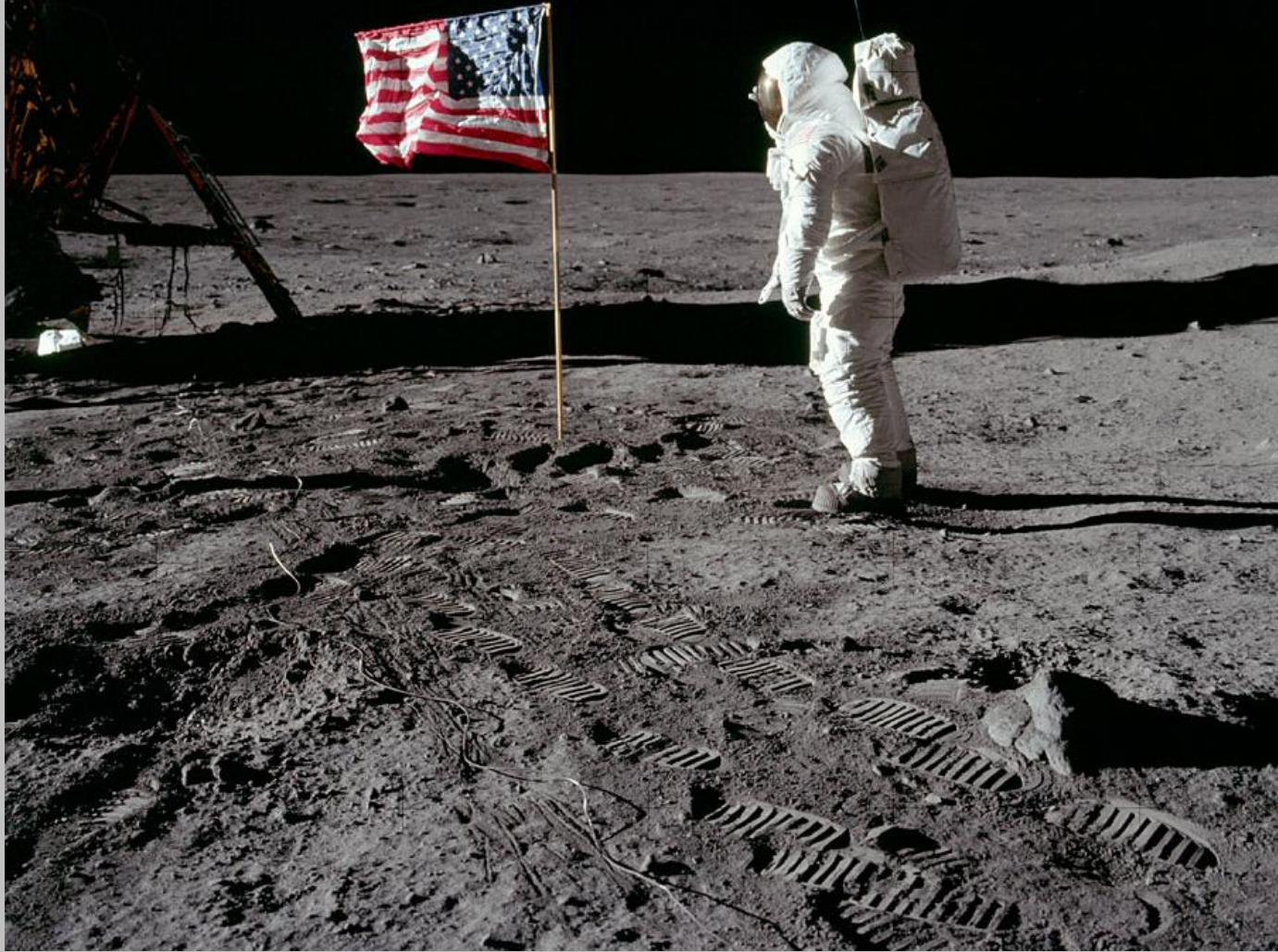


Explain Pseudo-Science

The Mars Hoax!



The Moon Hoax!



Show Cool Pictures!







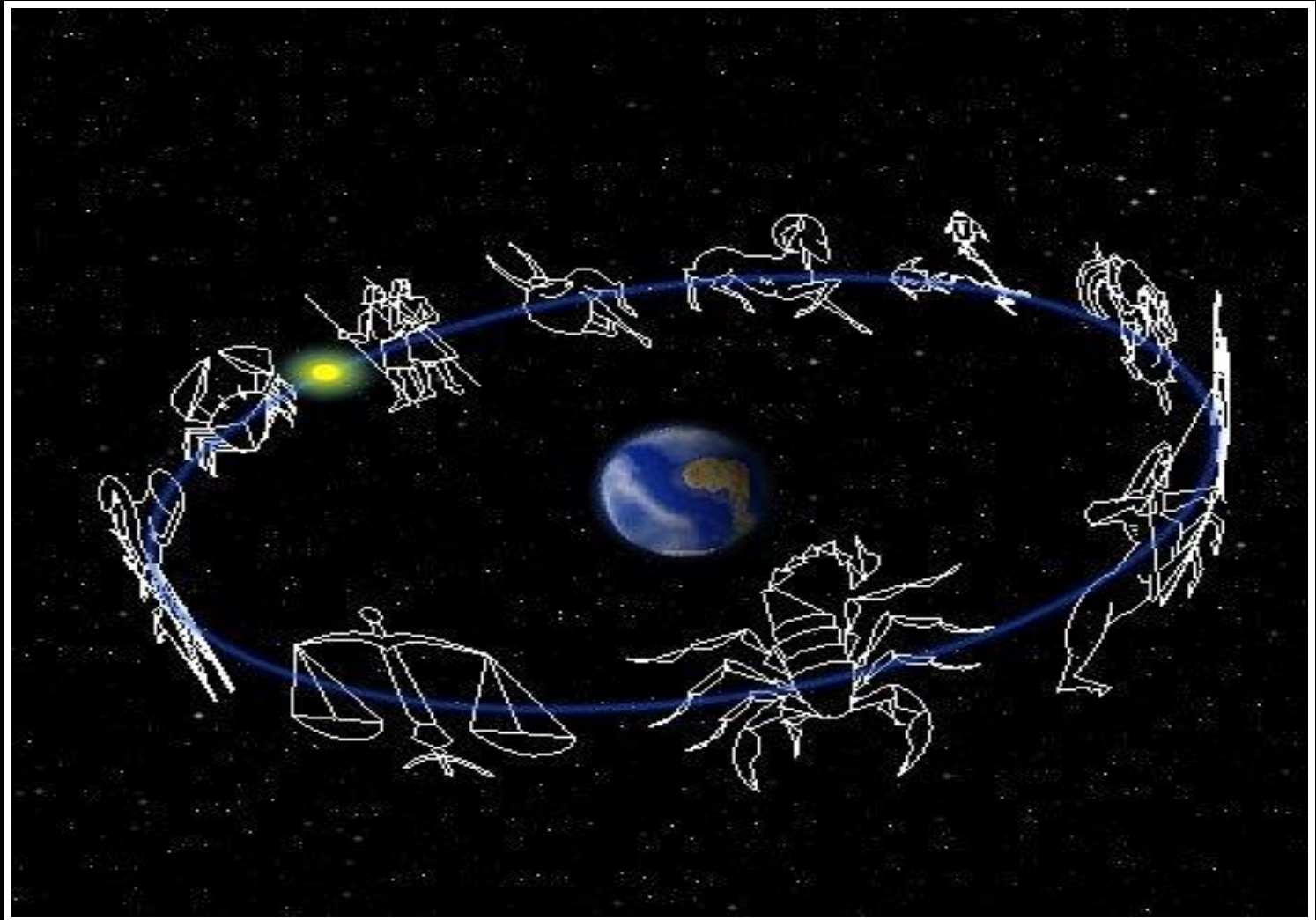


Astronomy Picture of the Day <http://antwrp.gsfc.nasa.gov>



Astronomy Picture of the Day <http://antwrp.gsfc.nasa.gov>

Answer Astrology Questions



Spot Satellites!



Space Dragon

25 May Magnitude 2.4

4:37:21am 10° W

4:40:00 am 29° NNW

4:42:57am 10° NE

International Space Station

25 May Magnitude -1.7

4:41:13am 10° W

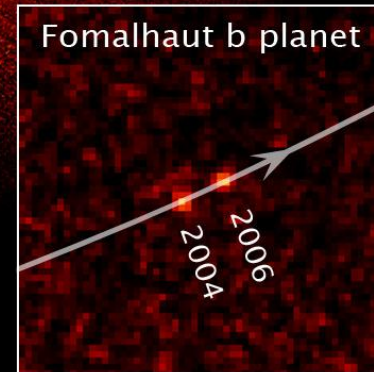
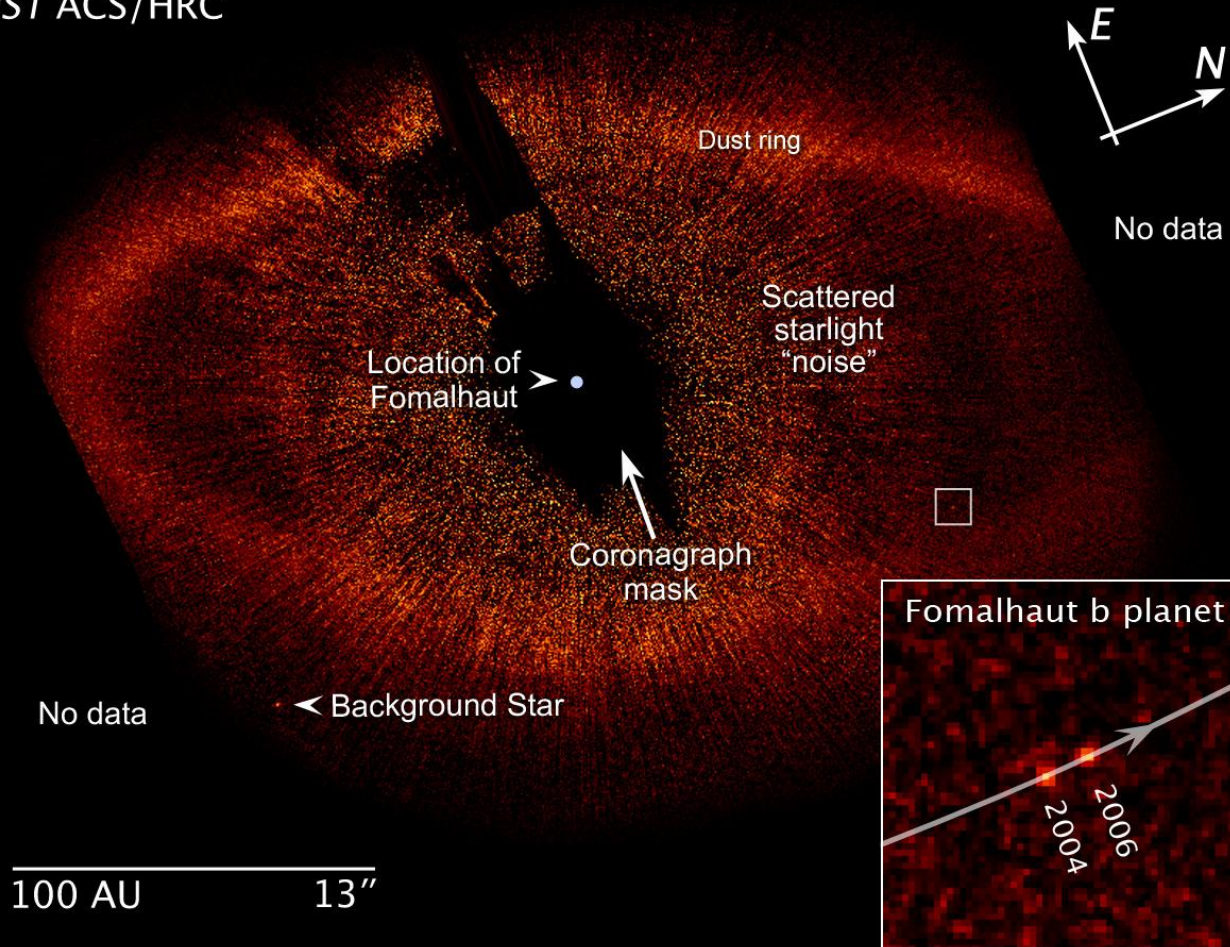
4:44:04am 29° NNW

4:46:57am 10° NE

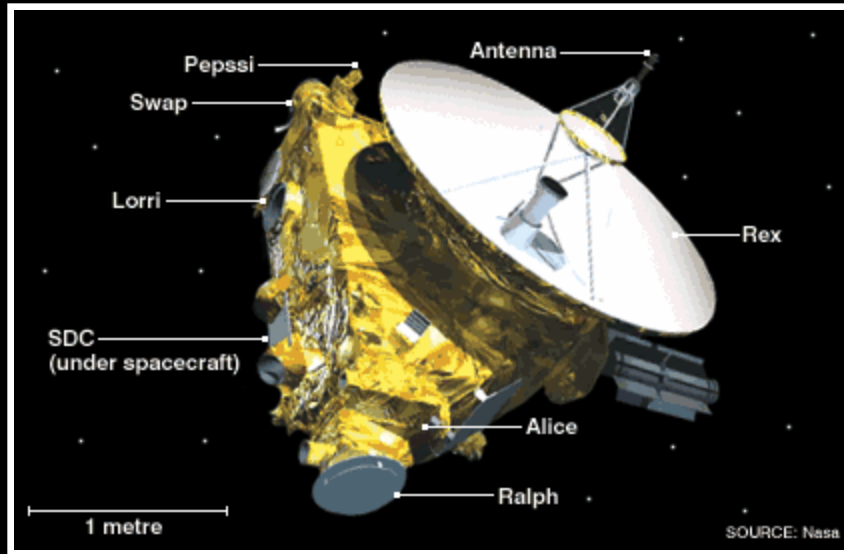
<http://heavens-above.com>

Universe Updates

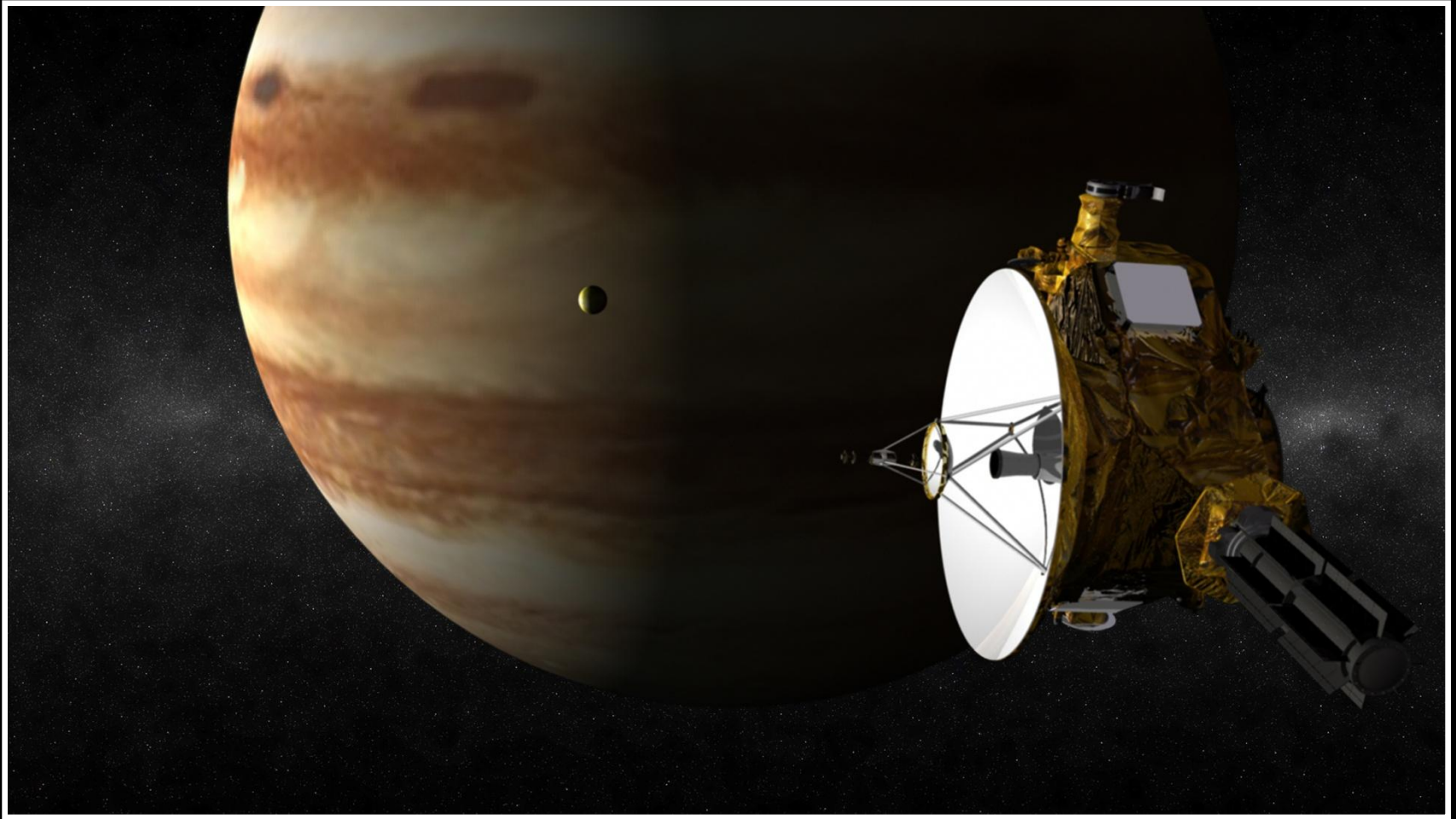
Fomalhaut
HST ACS/HRC



New Horizons arrives at Pluto in 2015!



Juno arrives at Jupiter in 2016!



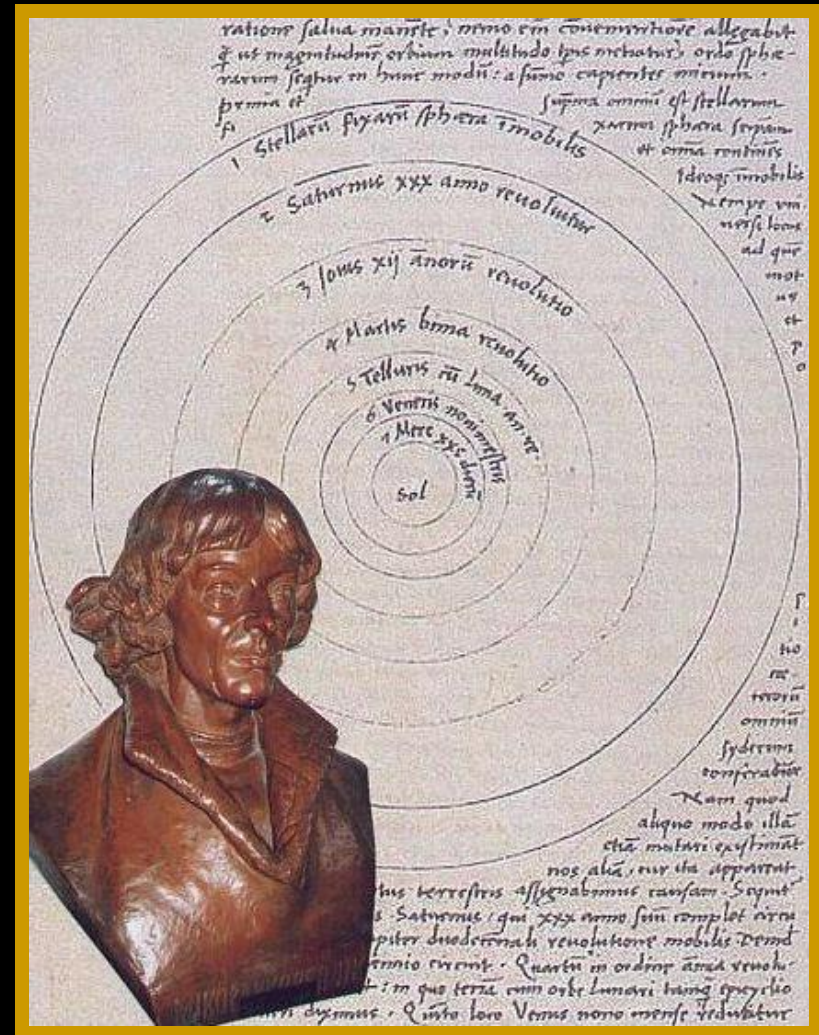
Understand UFOs & Aliens



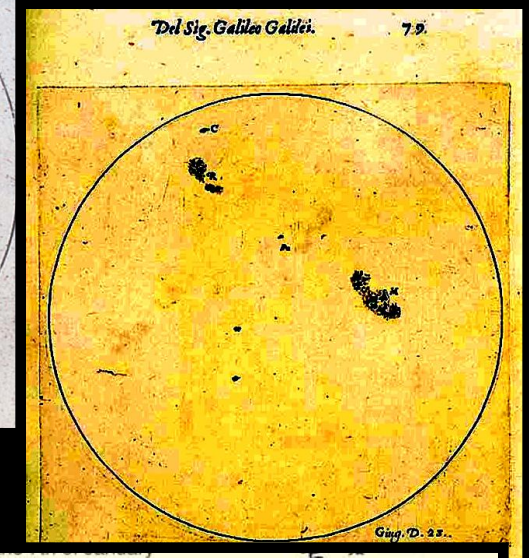
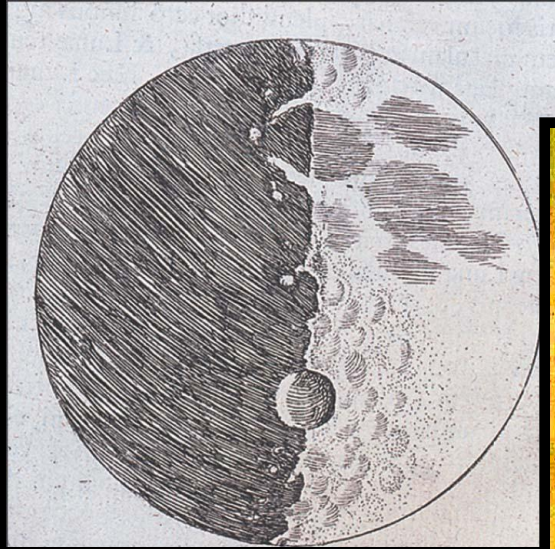
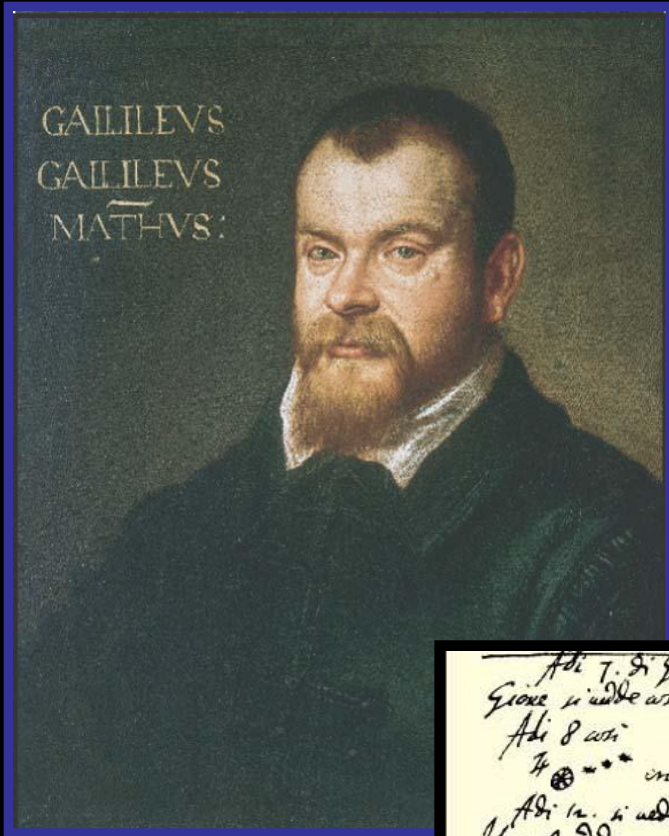
The Copernican Principle

We are not the center of the universe--physically.
Though we often think so psychologically.

- YOU
- CITY
- STATE
- NATION
- PLANET
- SUN
- GALAXY
- UNIVERSE



Galileo Galilei (1564-1642)



Adi 7. di Gennaio Giove si uede così

Adi 8 così

Adi 12. si uede in tale uisitazione

Adi 13. si uede due uicini: è a Giove 4 stelle

Adi 14 è rugolo

Adi 15

stante dalla 3^a il doppio l'aria

Lo spazio delle 3 occidentali non era maggiore del diametro di 7 et c. è: raso in linea retta.

7 long. 71. 38 Lat. 1. 19

Jupiter is seen thus

On the 8th thus

On the 12th day it is seen in this arrangement

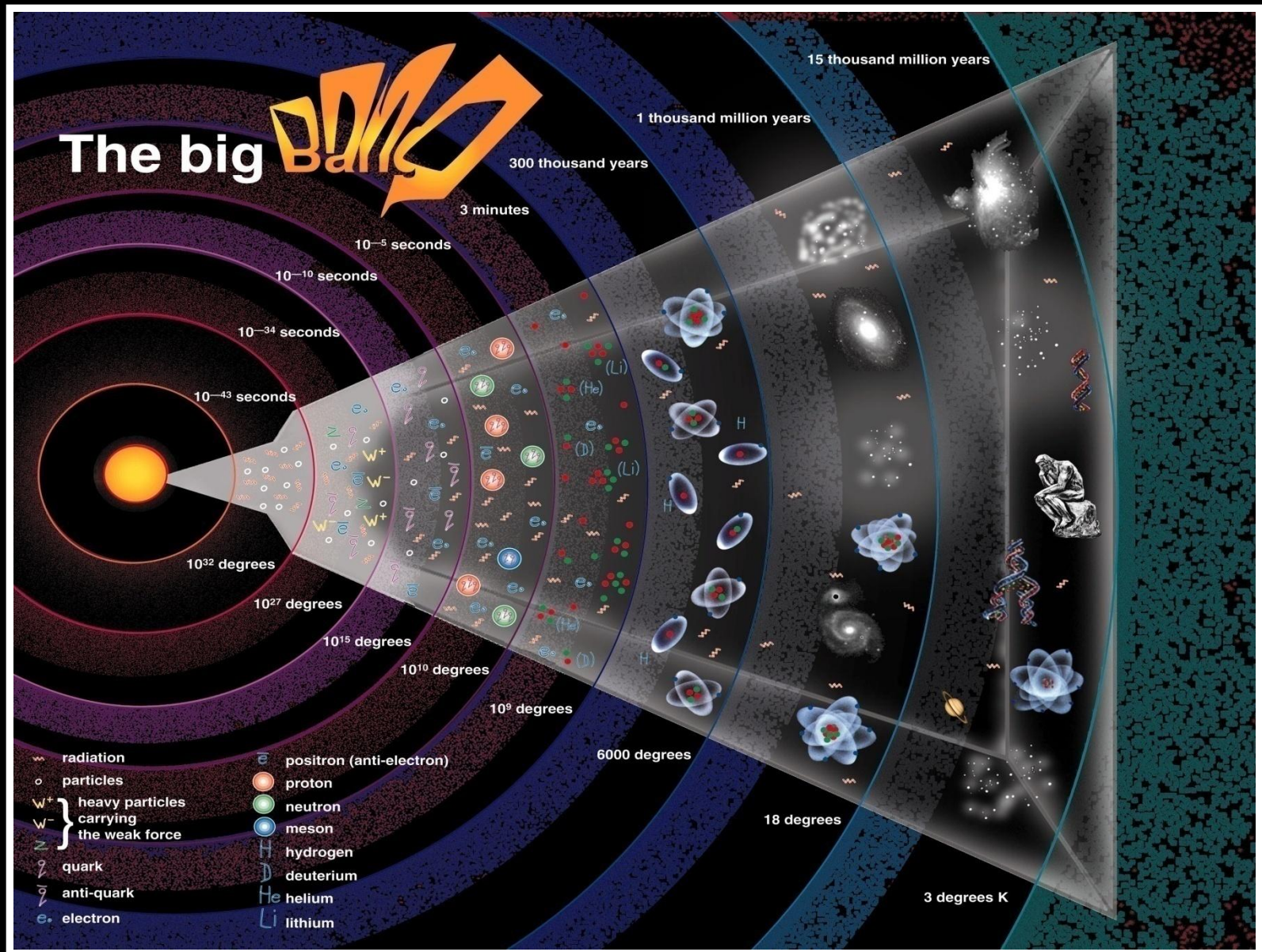
The 13th are seen very close to Jupiter 4 stars


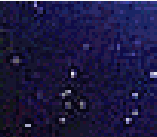
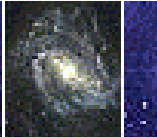
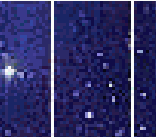
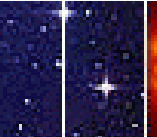
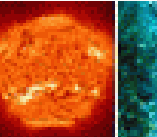
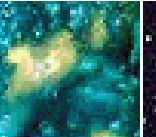
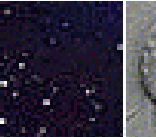

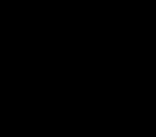
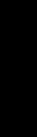
On the 14th it is cloudy

The 15th the nearest to Jupiter was small the 4th was distance from the 3rd about double

The spacing of the 3 to the west was no greater than the diameter of Jupiter and they were in a straight line.

Tell the Universe's Story



January	February	March	April	May	June	July	August	September	October	November
										

New Year's Day: The Big Bang

Milky Way forms

Sun and planets form

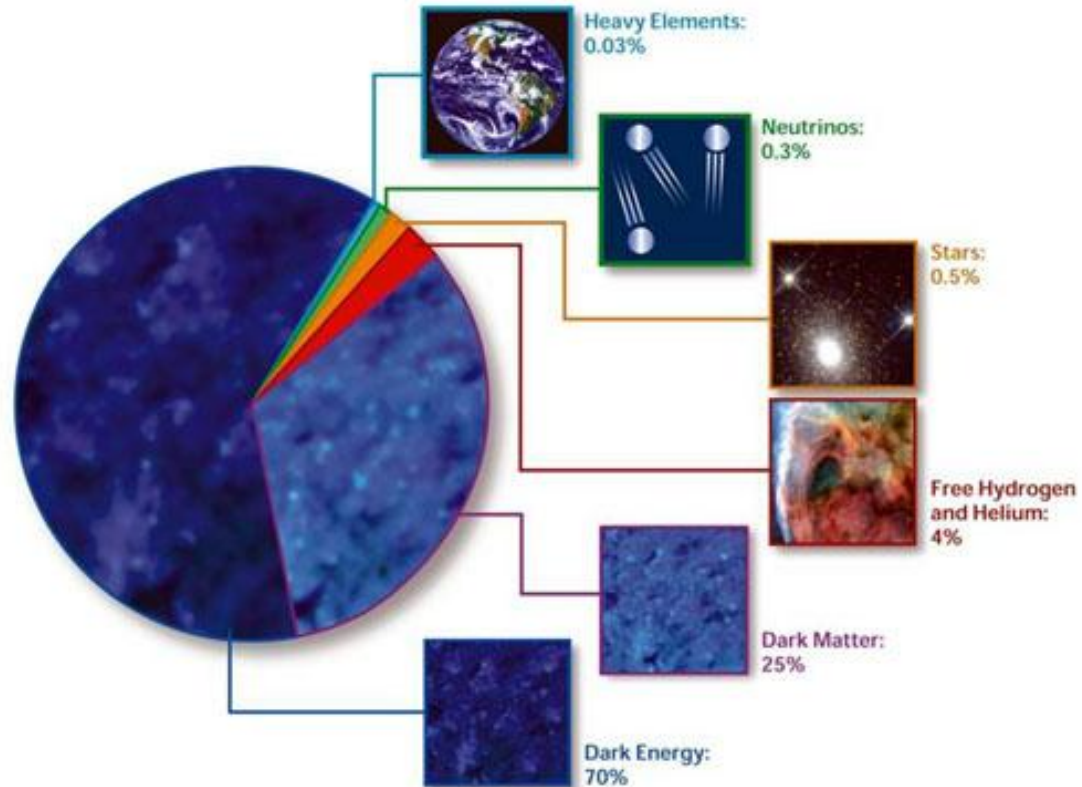
Oldest known life (single celled).

First multi-cellular organisms

December

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15 Cambrian Explosion (burst of new life forms)	16	17 Emergence of first vertebrates	18 Early land plants	19	20 First four-limbed animals	21 Variety of insects begin to flourish
22	23	24 First dinosaurs appear	25 First mammalian ancestors appear	26	27 First known birds	28
29  Dinosaurs wiped out by asteroid or comet	30	31 10:15am Apes appear 9:24pm First human ancestors to walk upright 10:48pm Homo erectus appears 11:54pm Anatomically modern humans appear 11:59:45pm Invention of writing 11:59:50pm Pyramids built in Egypt 1 second before midnight: Voyage of Christopher Columbus				

COMPOSITION OF THE COSMOS

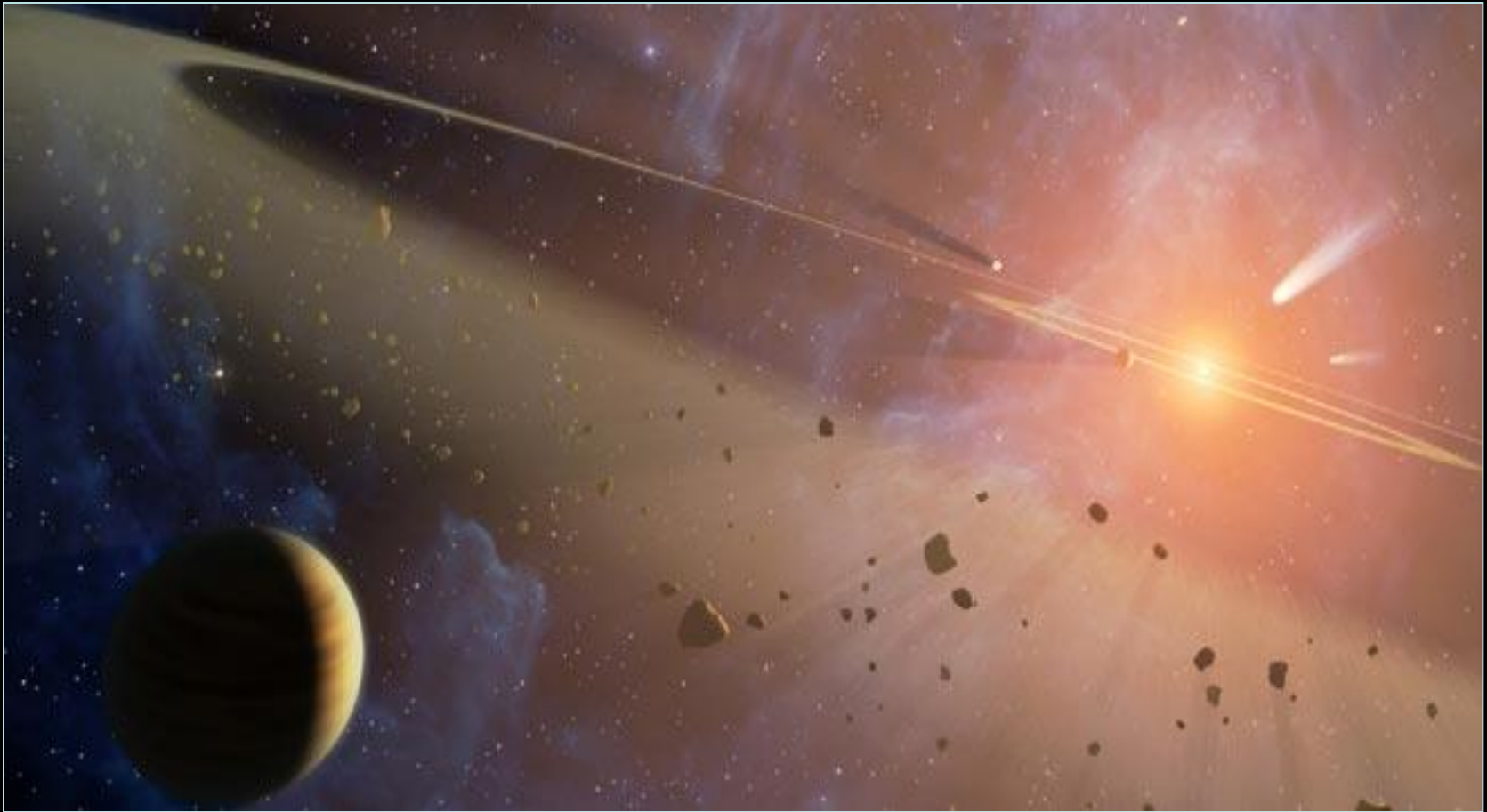


*Inspiration
Imagination
Investigation*



Journey to the Stars

A Fascinating Trip through the Universe



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MUSEUM

Robert Bonadurer
Director, Planetarium & IMAX

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Daniel M. Soref Planetarium





*Thousands of Stars
Performing Daily!*



