

Reminder: no food or
drinks in the planetarium!

Astronomy 4 - Solar System Astronomy

Reminders

Instructor: Dr. Ann Marie Cody

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

Class website:

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

Your one-stop shop for anything course related, including homework readings and exam practice material.

Lost and found:

-At the end of class, check to make sure you aren't leaving anything behind. Any items will be added to the Lost and Found box in back.

Scale of the universe

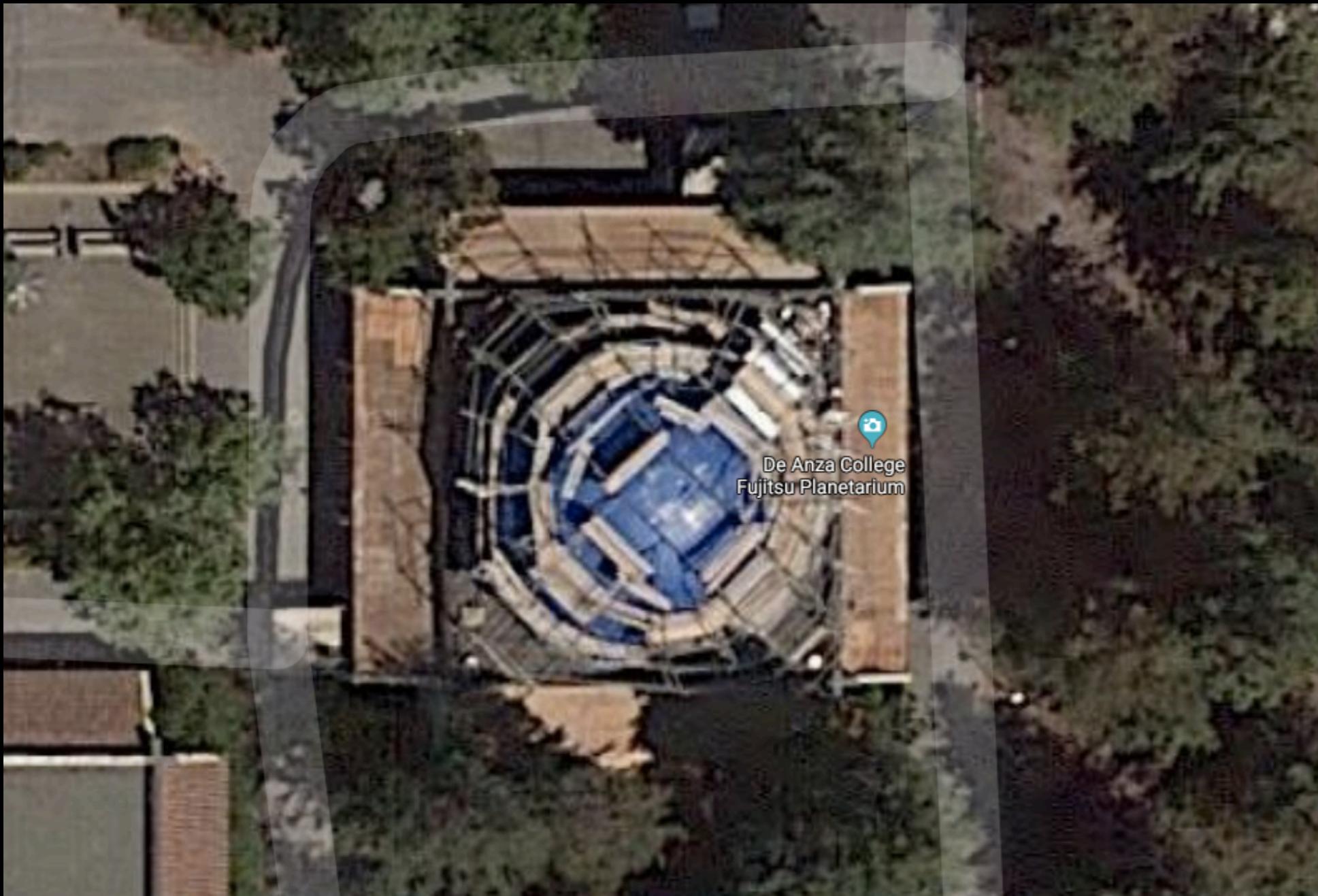
- We will compare objects of different sizes in order to comprehend the scale of the universe.



We'll begin with something familiar—like this campus and its surroundings.

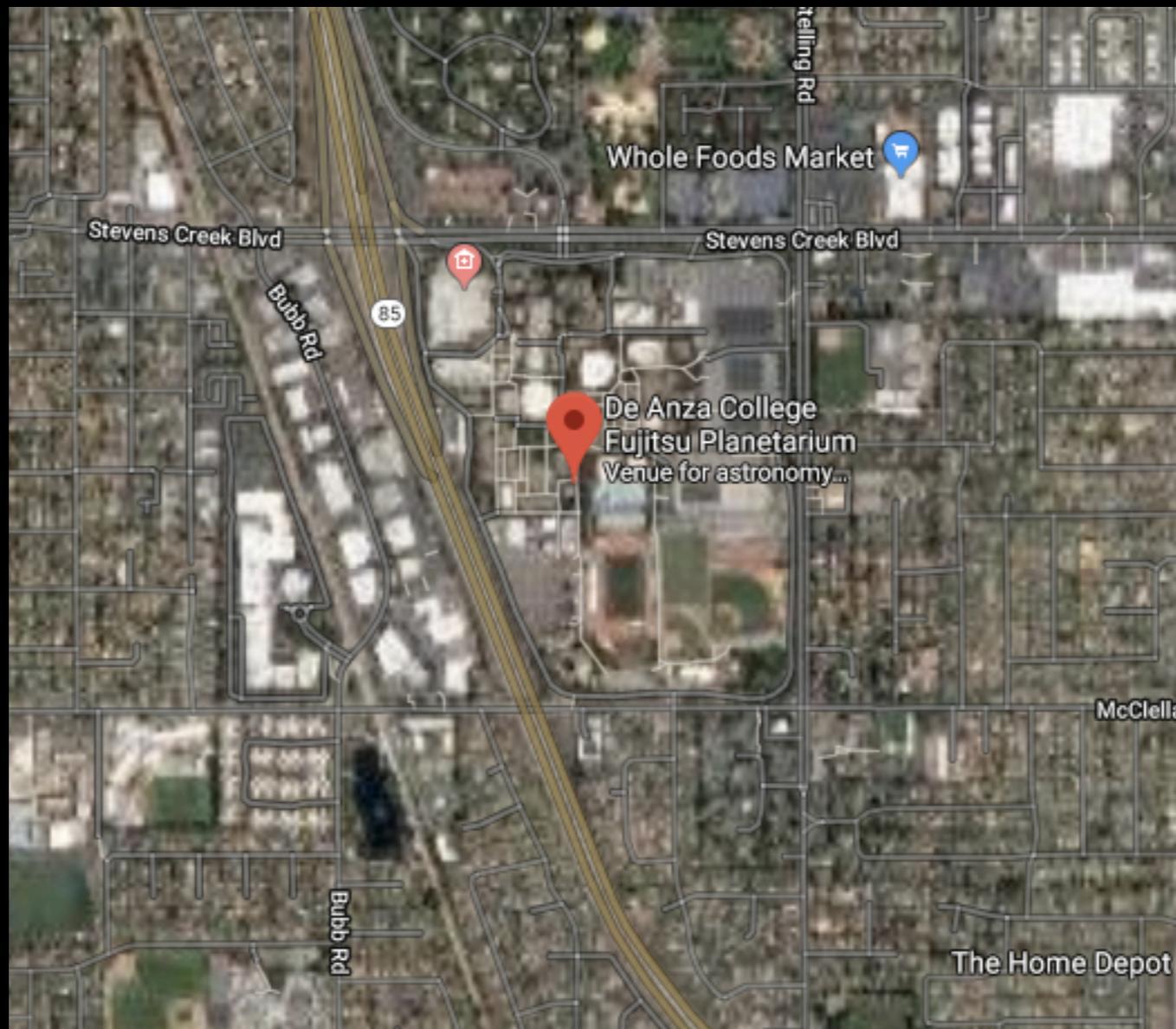


The figure shows a region about **52 feet** across, which is a bit smaller than this planetarium's dome.



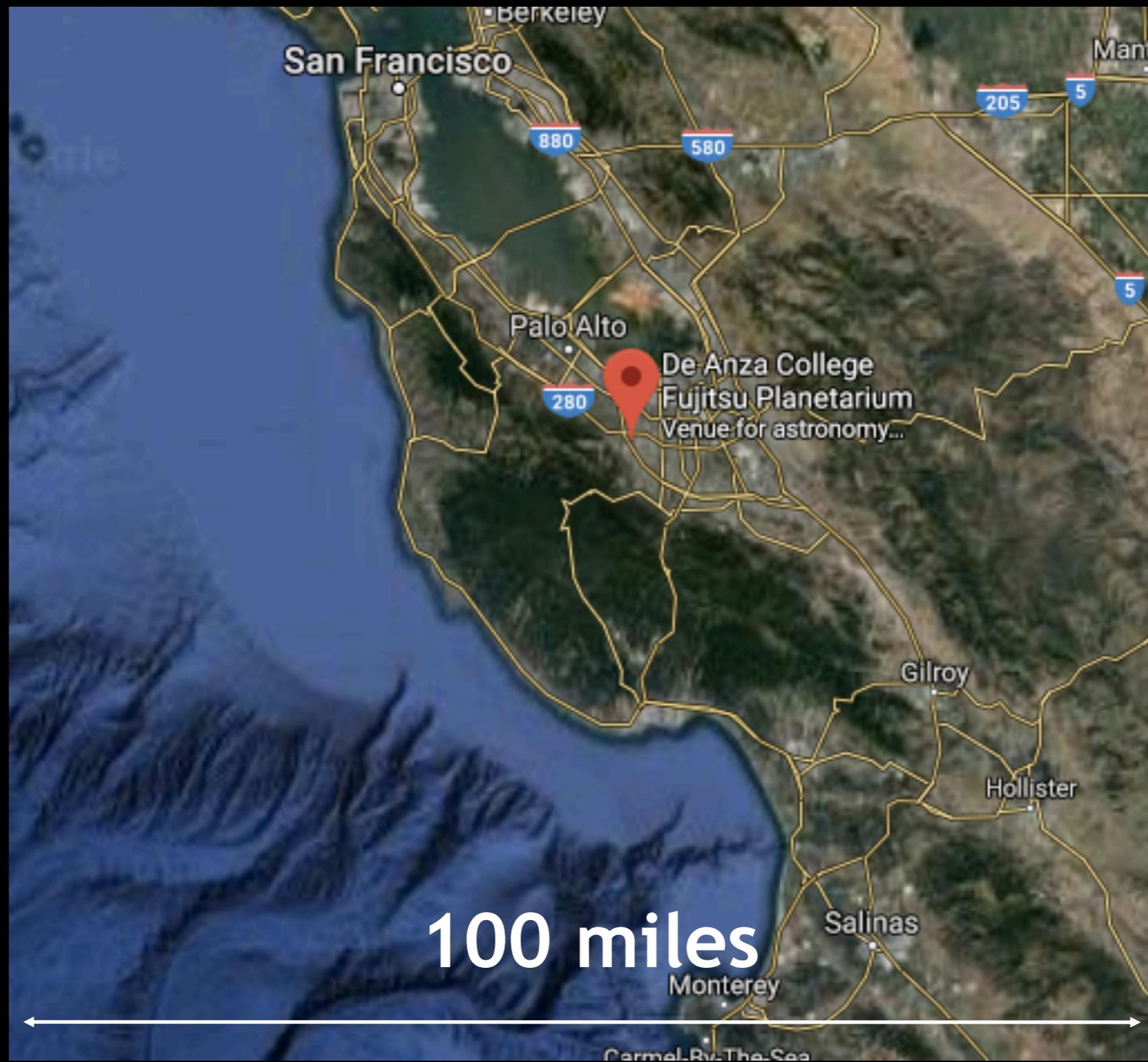
52 feet

- Increase the field of view by a factor of 100, and you can see a region 1 mile across.

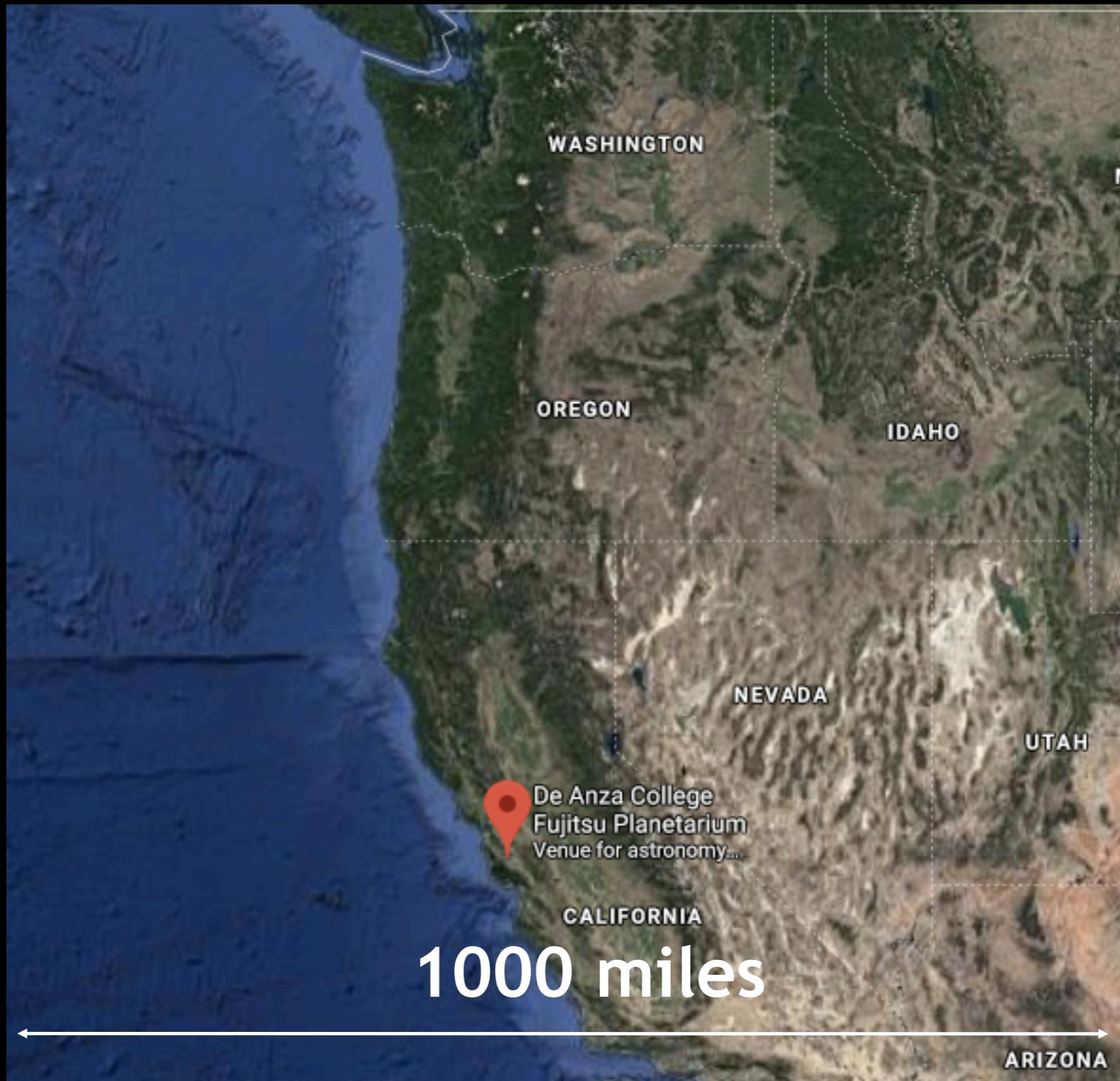


1 mile

At 100 miles we have the Bay Area



At 1000 miles we have the whole west coast

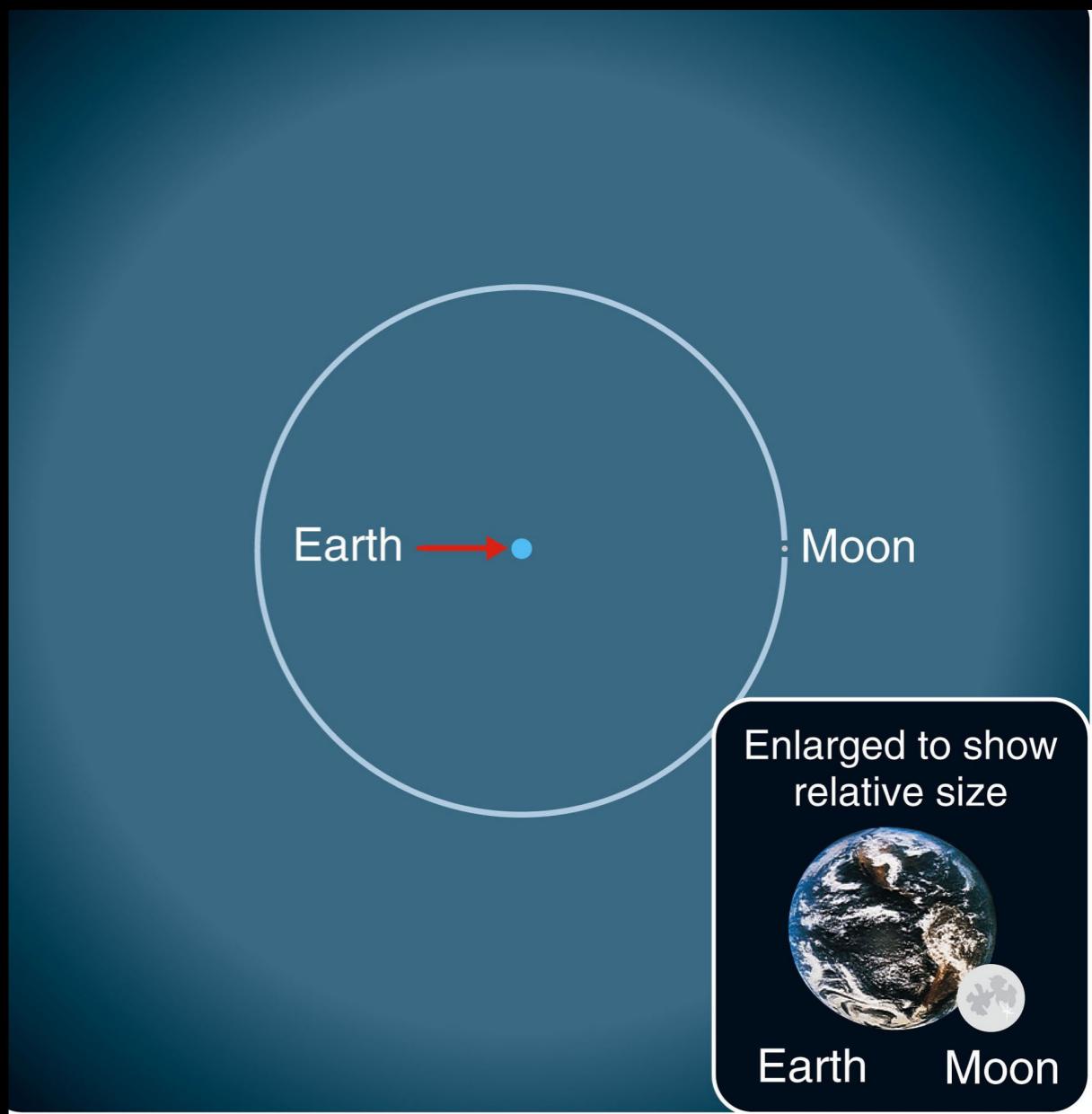


At about 8000 miles in diameter, we see the entire planet Earth.

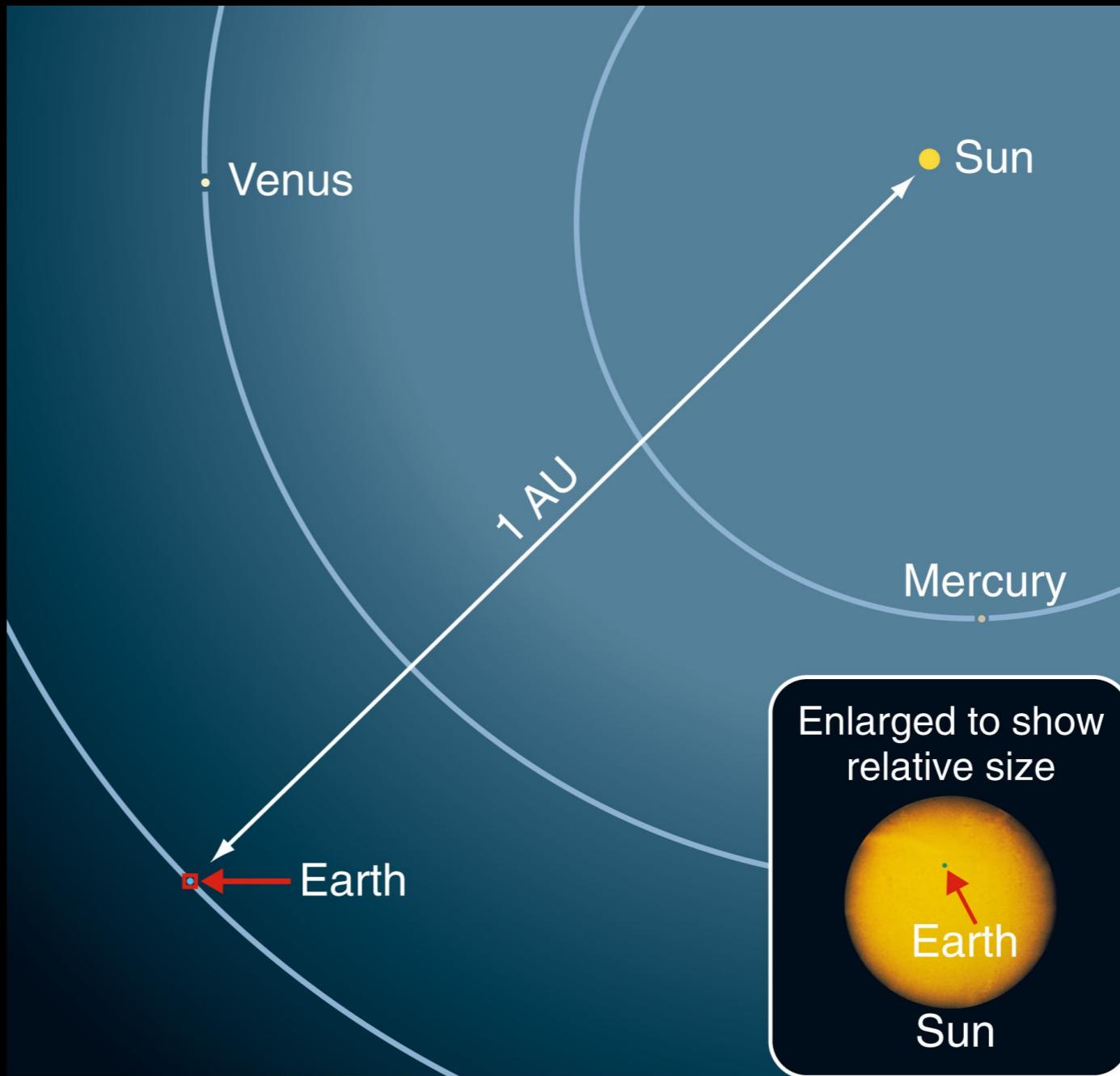


At 1 million miles wide ...

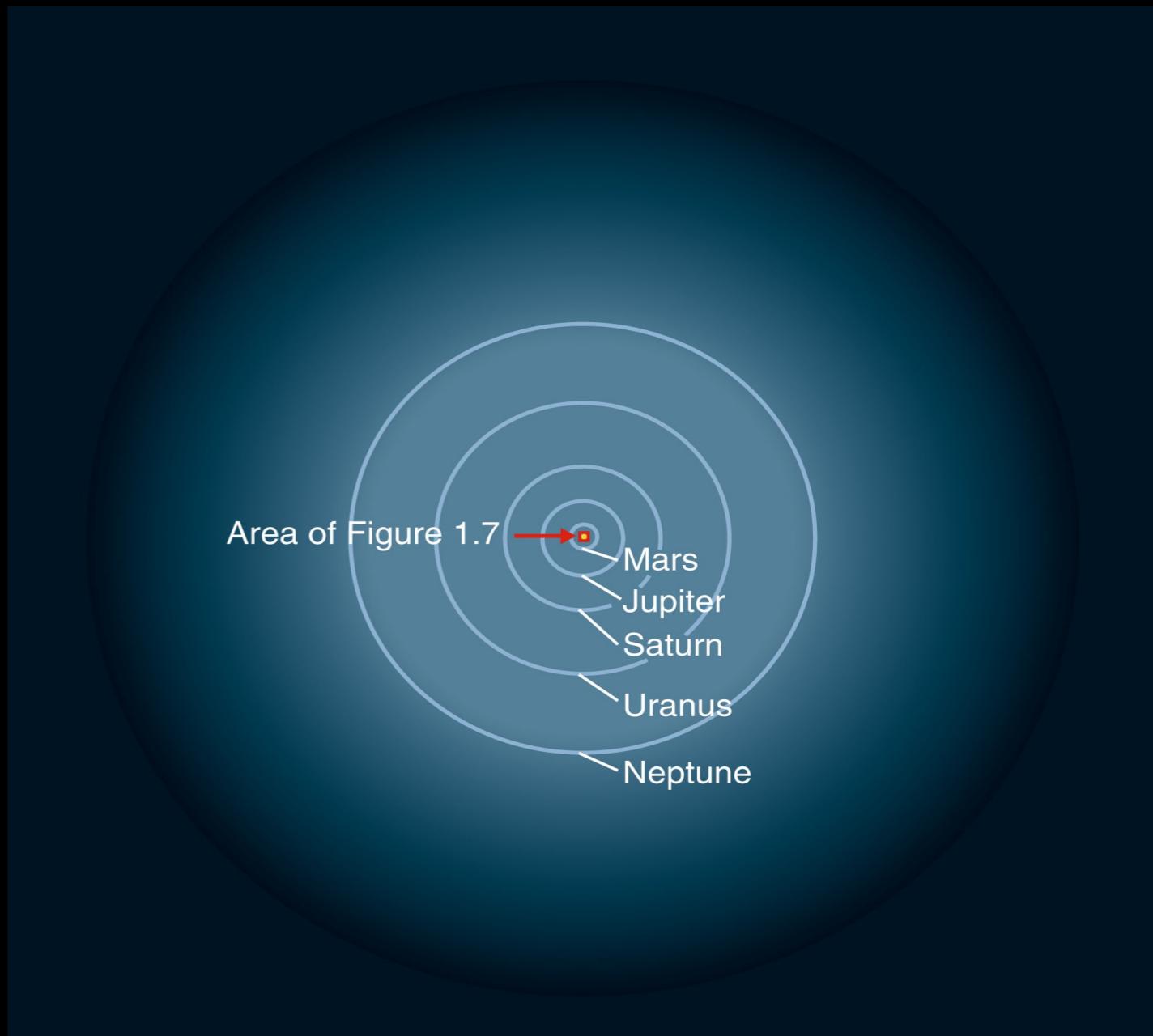
- Earth is the small blue dot in the center.
- The moon—with a diameter of only about one-fourth that of Earth—is an even smaller dot along its orbit.



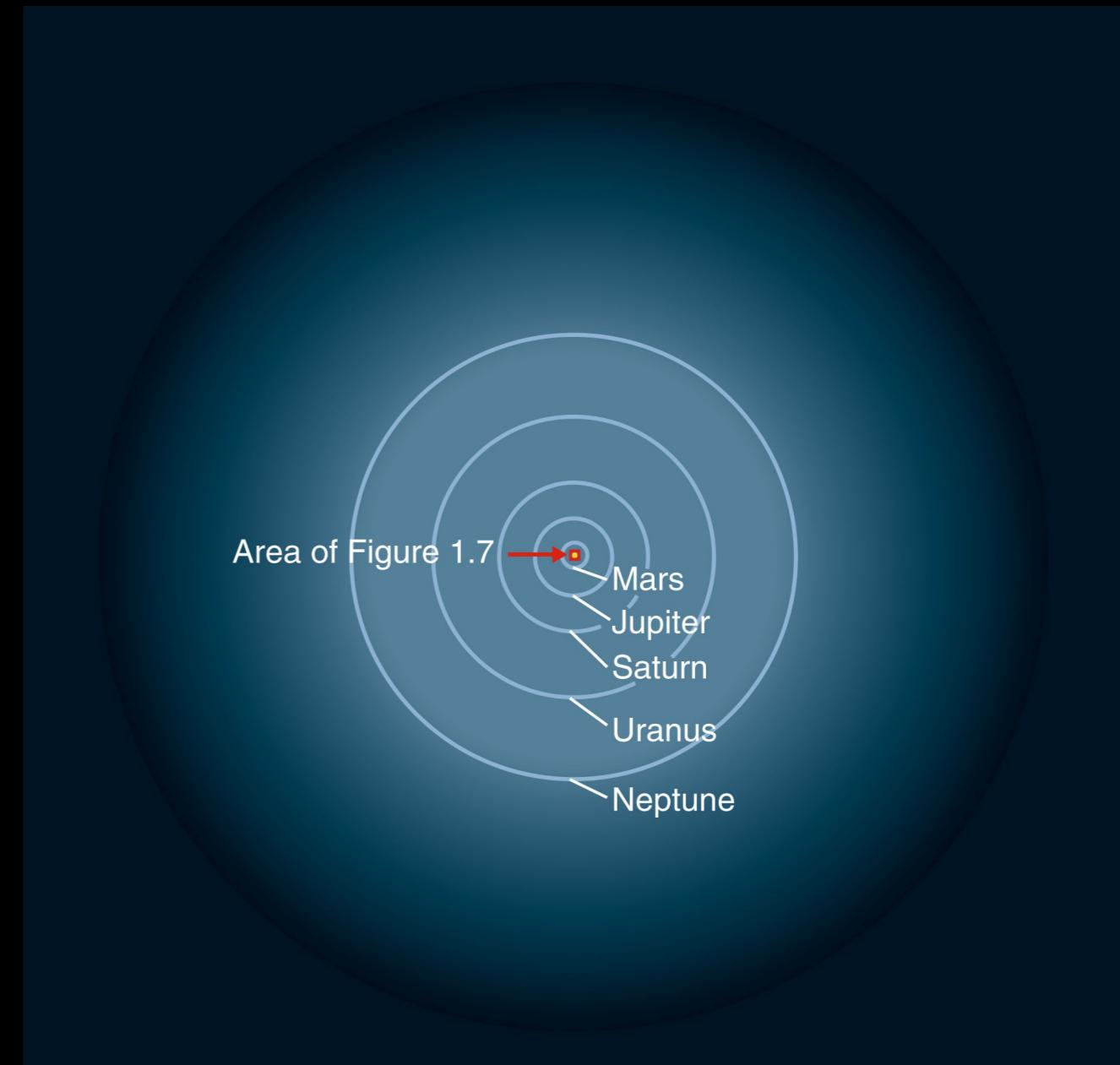
At 100 million miles across, Earth, its moon, and the moon's orbit all lie in the small red box at lower left.



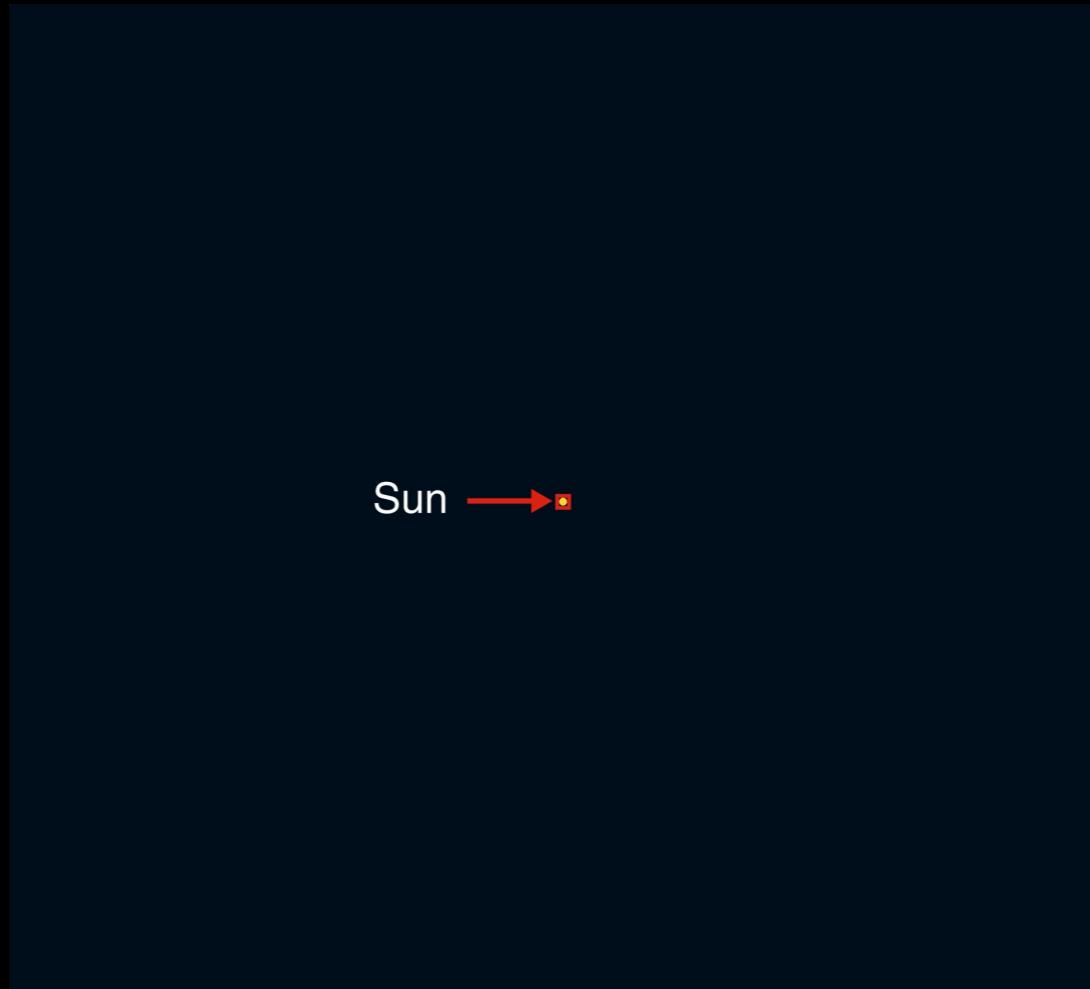
After just six steps, 10000 million miles (10 billion), each enlarging by a factor of ~100 each time, we see the entire solar system.



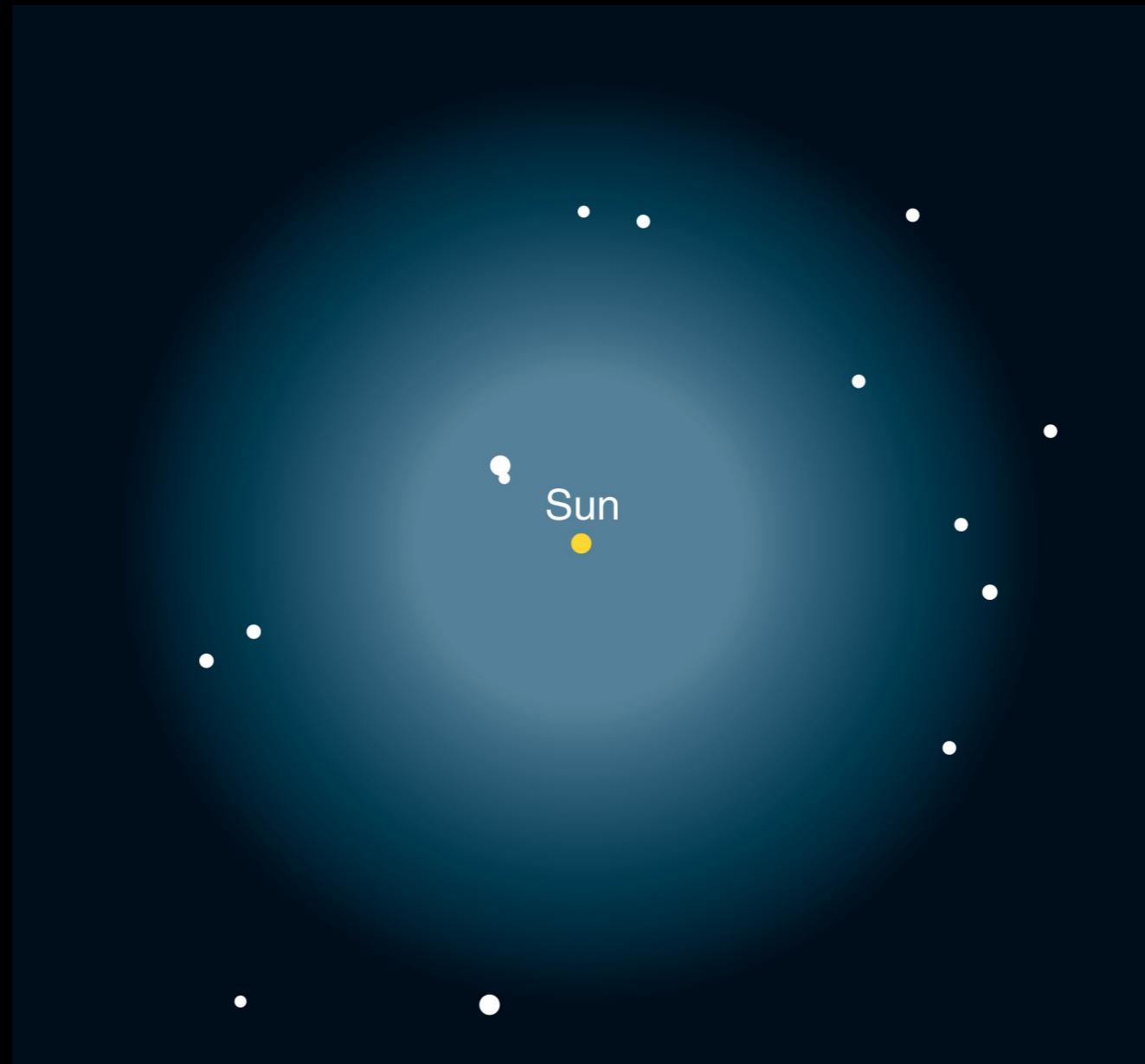
- This view now is 1 trillion (10^{12}) times wider than in the first figure.



When we enlarge the field of view by another factor of 100, the solar system becomes invisibly small -



Increase by another factor of 100, and the field of view has expanded to a diameter of **10^{14} miles** or a bit over 1 million AU (17 ly).



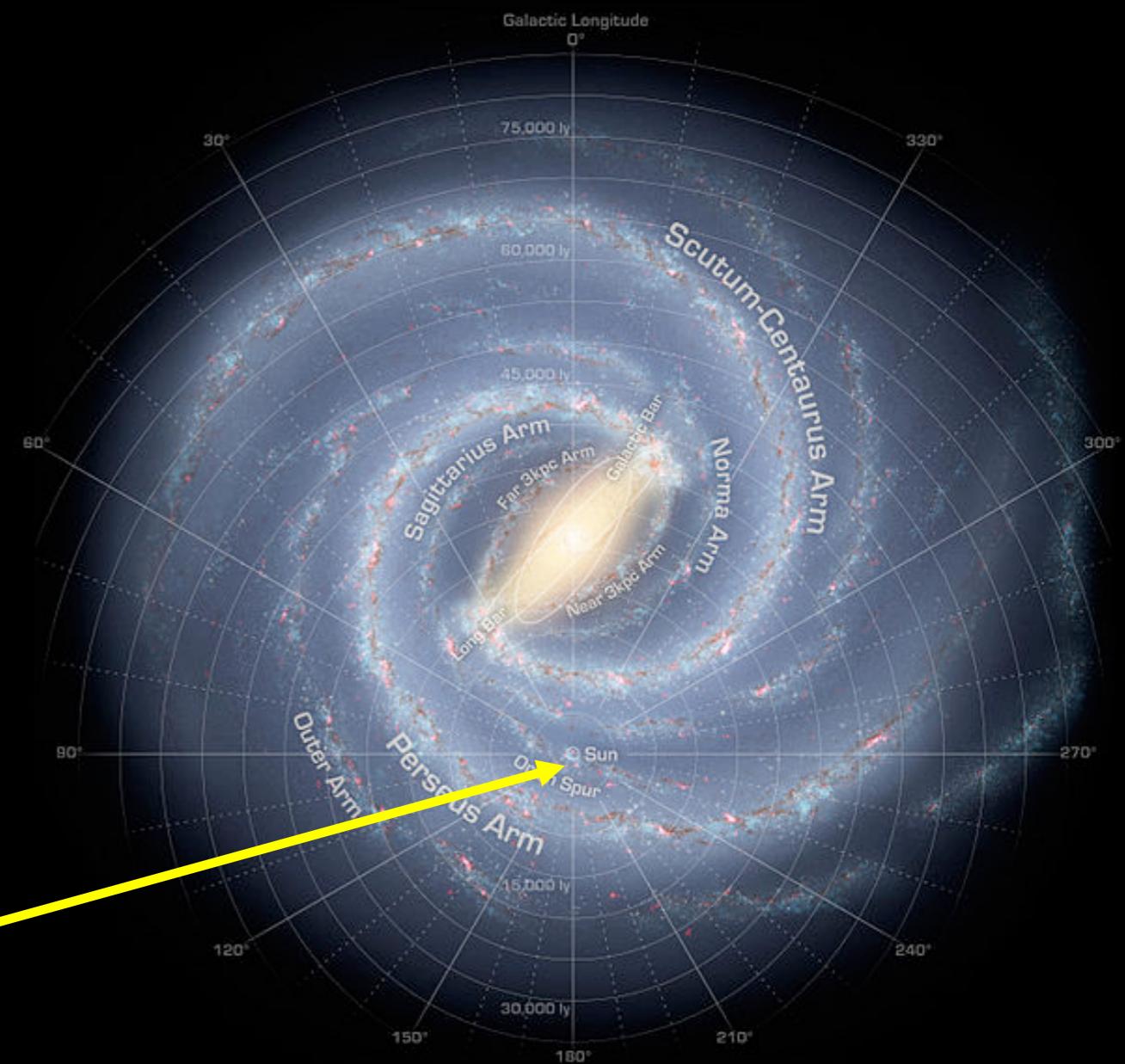
Another factor of 100 (1700 ly, 10^{16} miles across), the Sun and its neighboring stars vanish into the background of thousands of other stars.



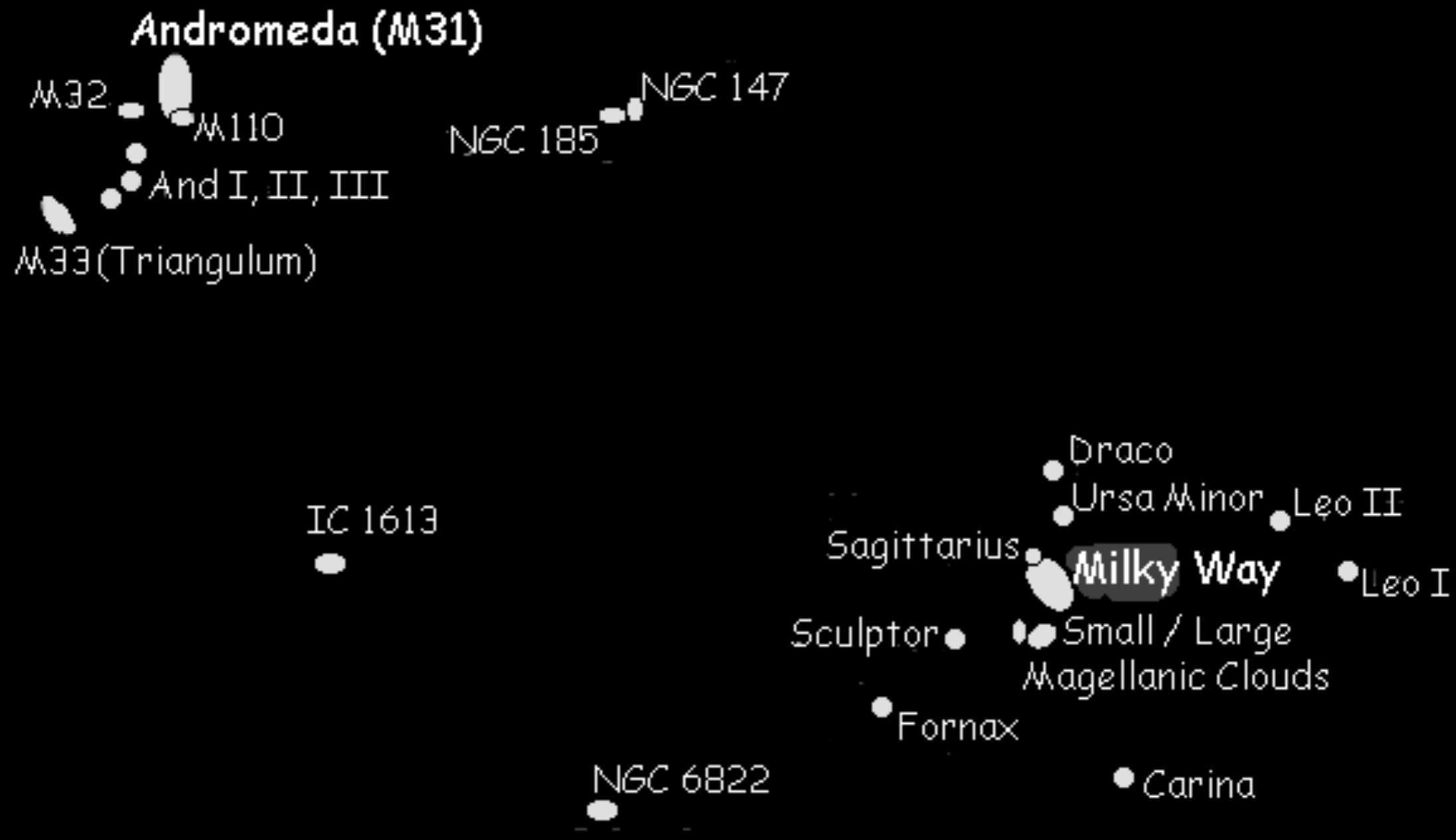
Another factor of 100, we see our galaxy - the Milky Way

- A **galaxy** is a great cloud of stars, gas, and dust bound together by the combined gravity of all the matter.

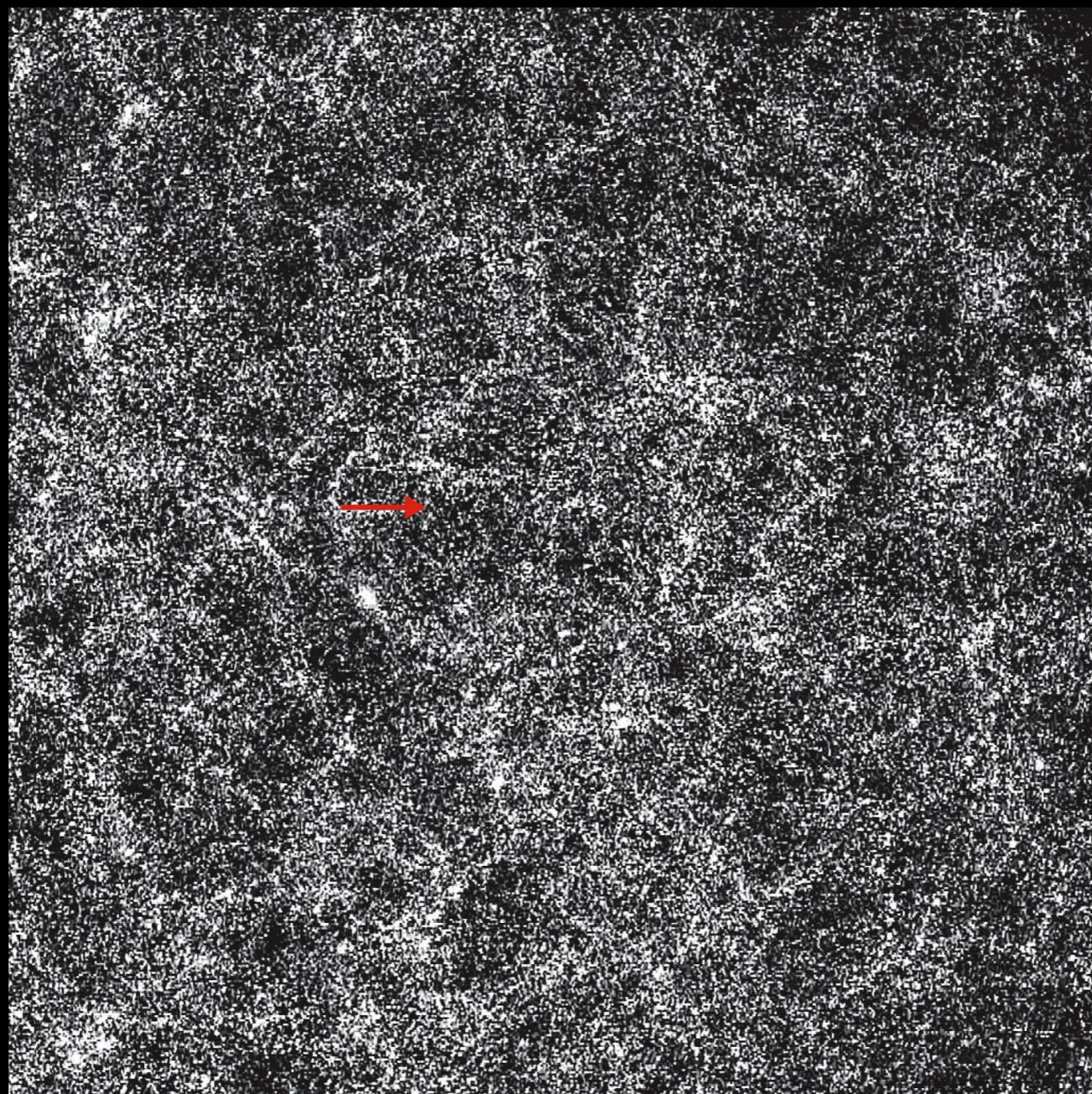
We are here



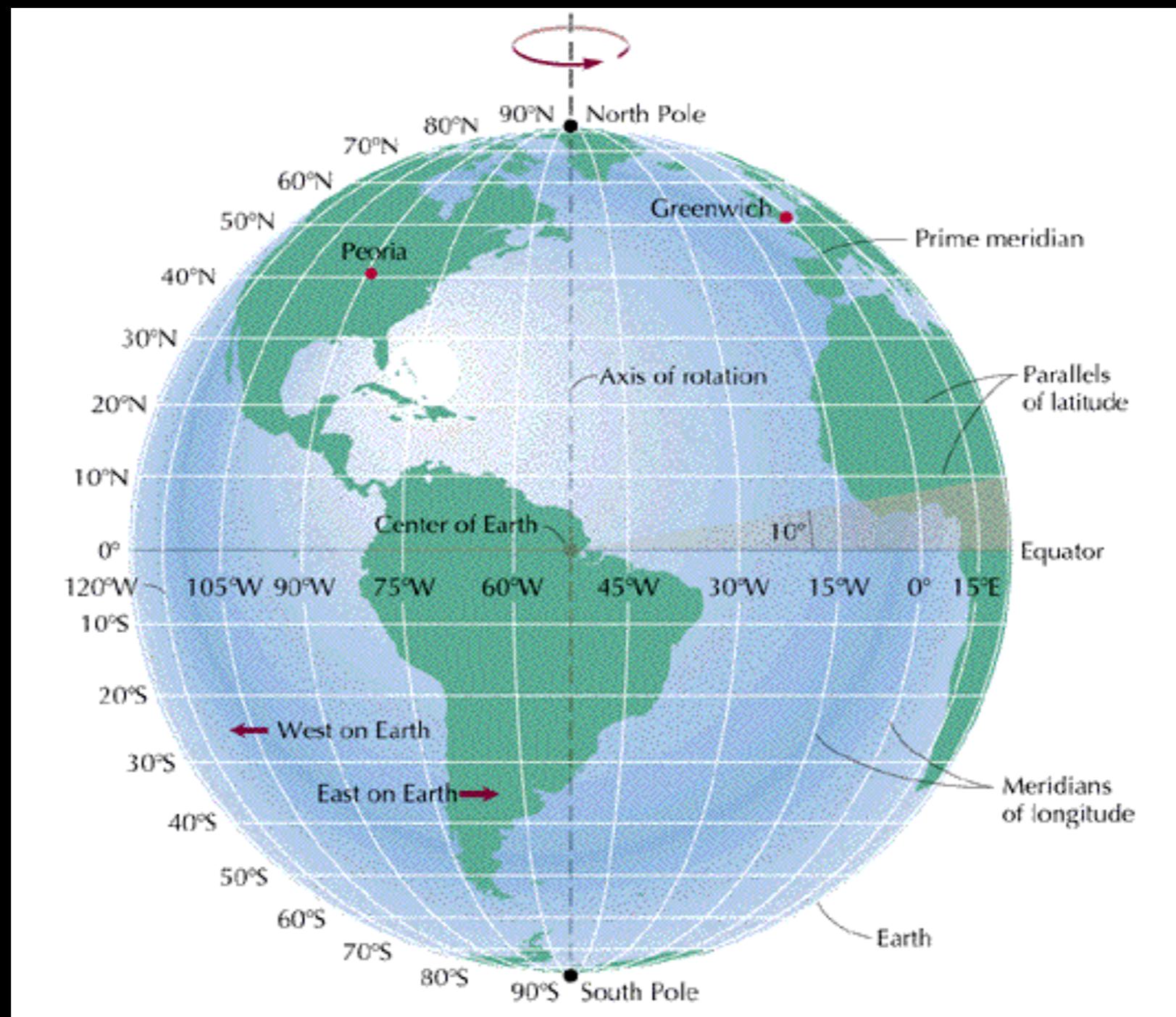
Expand your field of view by another factor of 100 (17 million ly, 10^{18} miles), our galaxy appears as a tiny luminous speck surrounded by other specks.



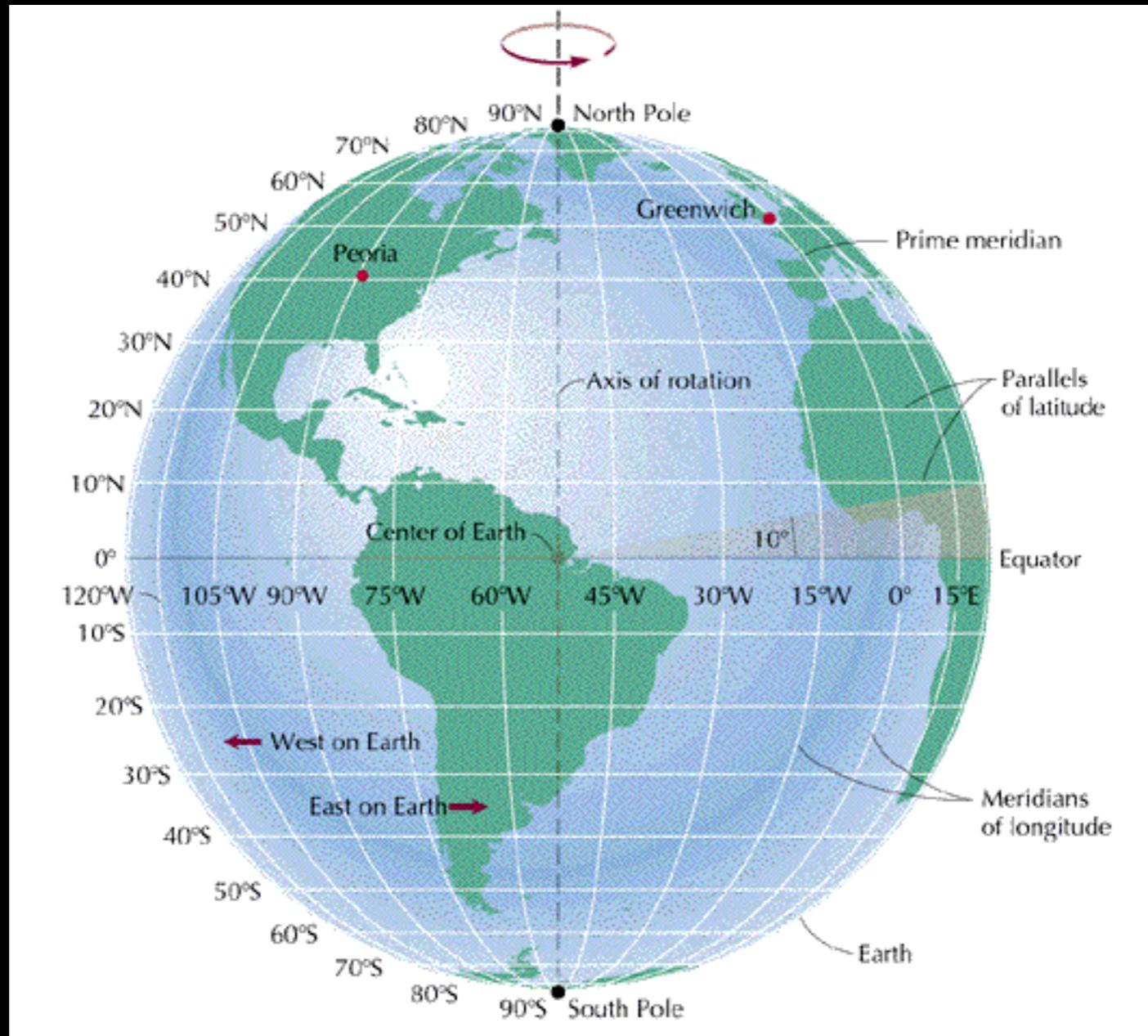
Finally, a view with a diameter of 1.7 billion light years (10^{20} miles) by combining observations with theoretical calculations



Now let's zoom back down to Earth...



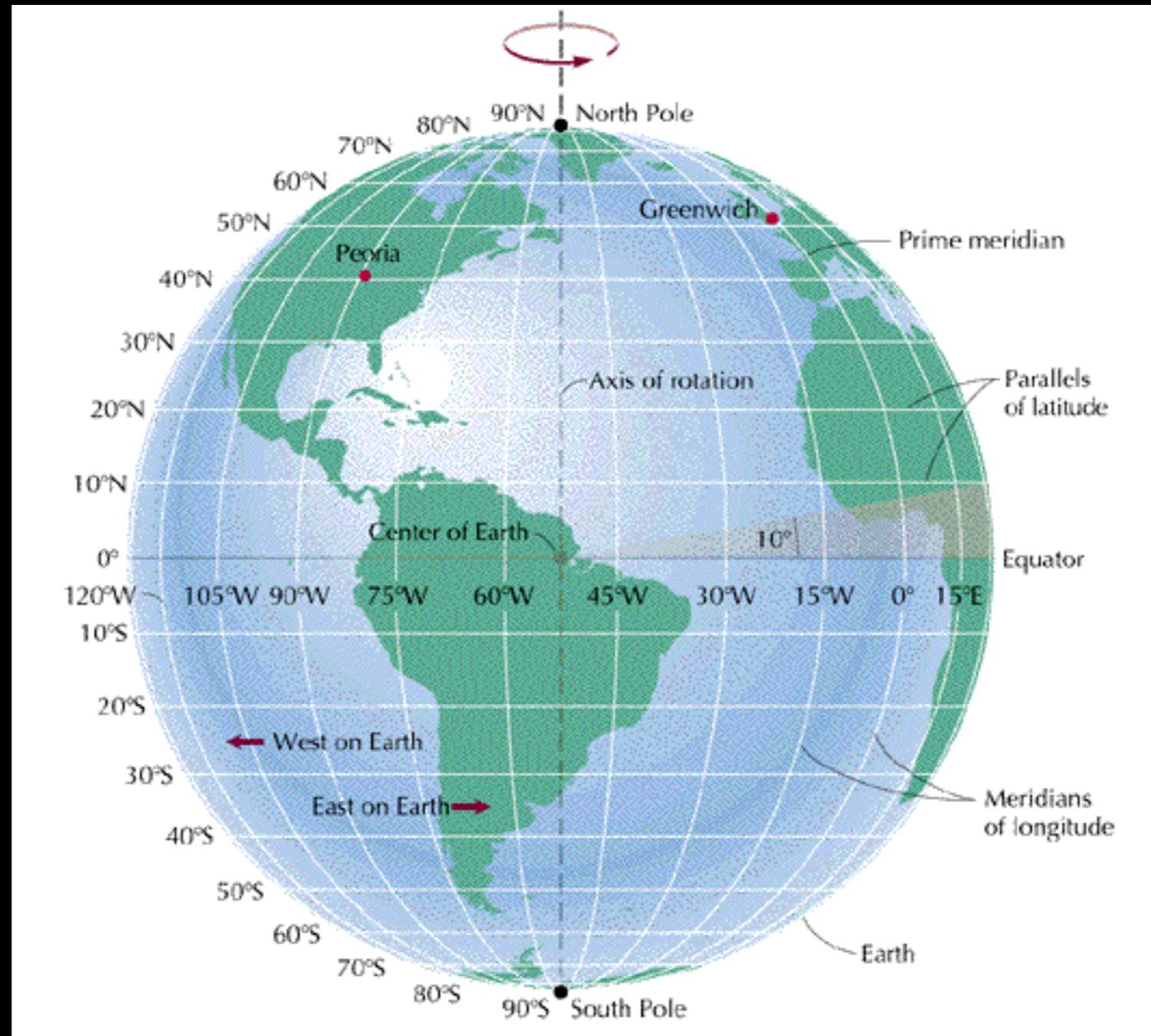
Some Geography ON the Earth



Latitude - parallel lines running East/West

Longitude - great circles running North/South

First: Some Geography ON the Earth



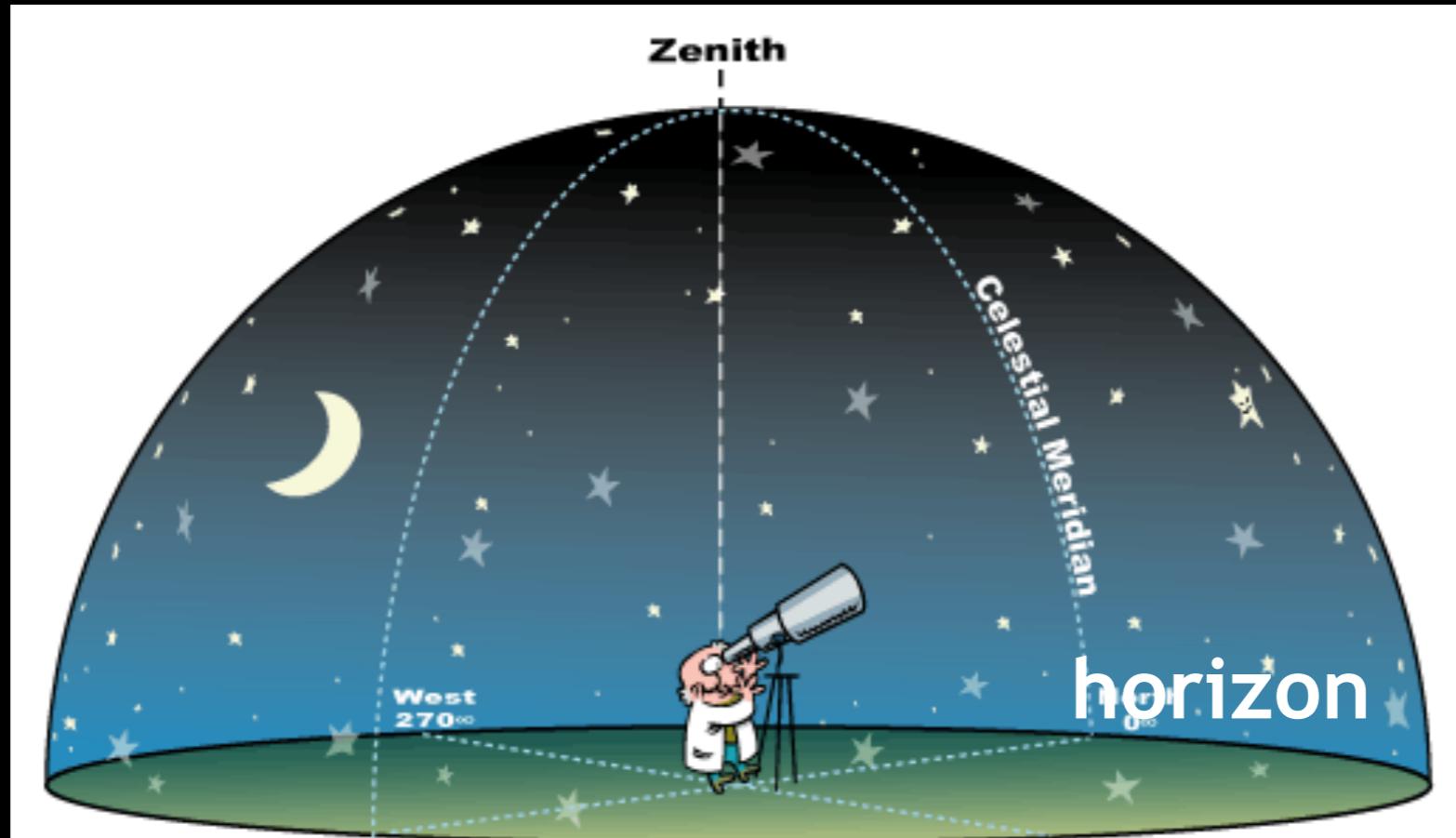
Latitude - parallel lines running East/West

Longitude - great circles running North/South

Ex: San Jose- 37°N 122°W

Now, geography on the sky

These features pertain to your location ANYWHERE on Earth



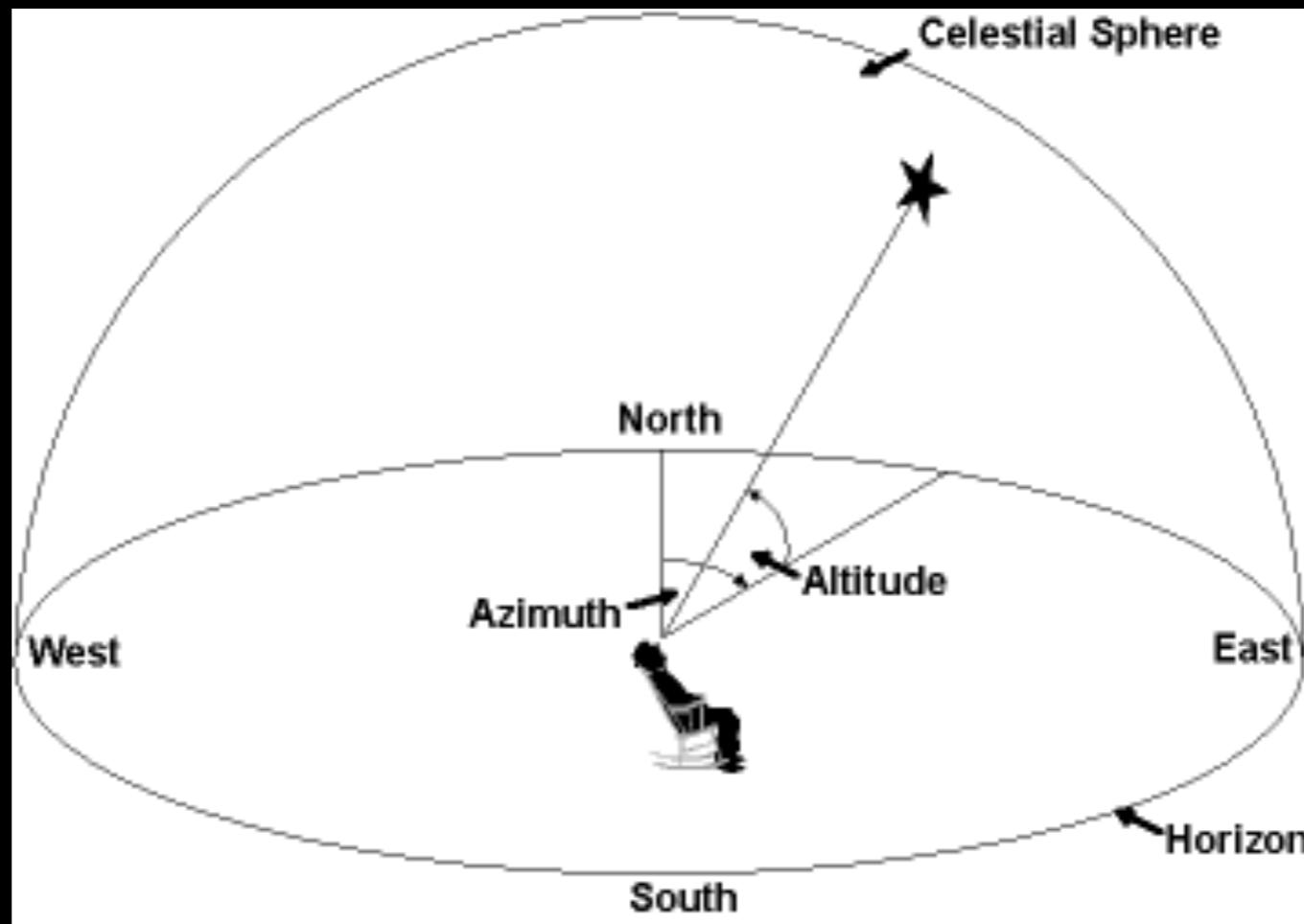
Zenith - point directly above your head

Nadir - point directly below

Horizon - circle of ground around you

Meridian - line from the North to the South

The local location of an object in the night sky



Altitude - angle of a star above your horizon*

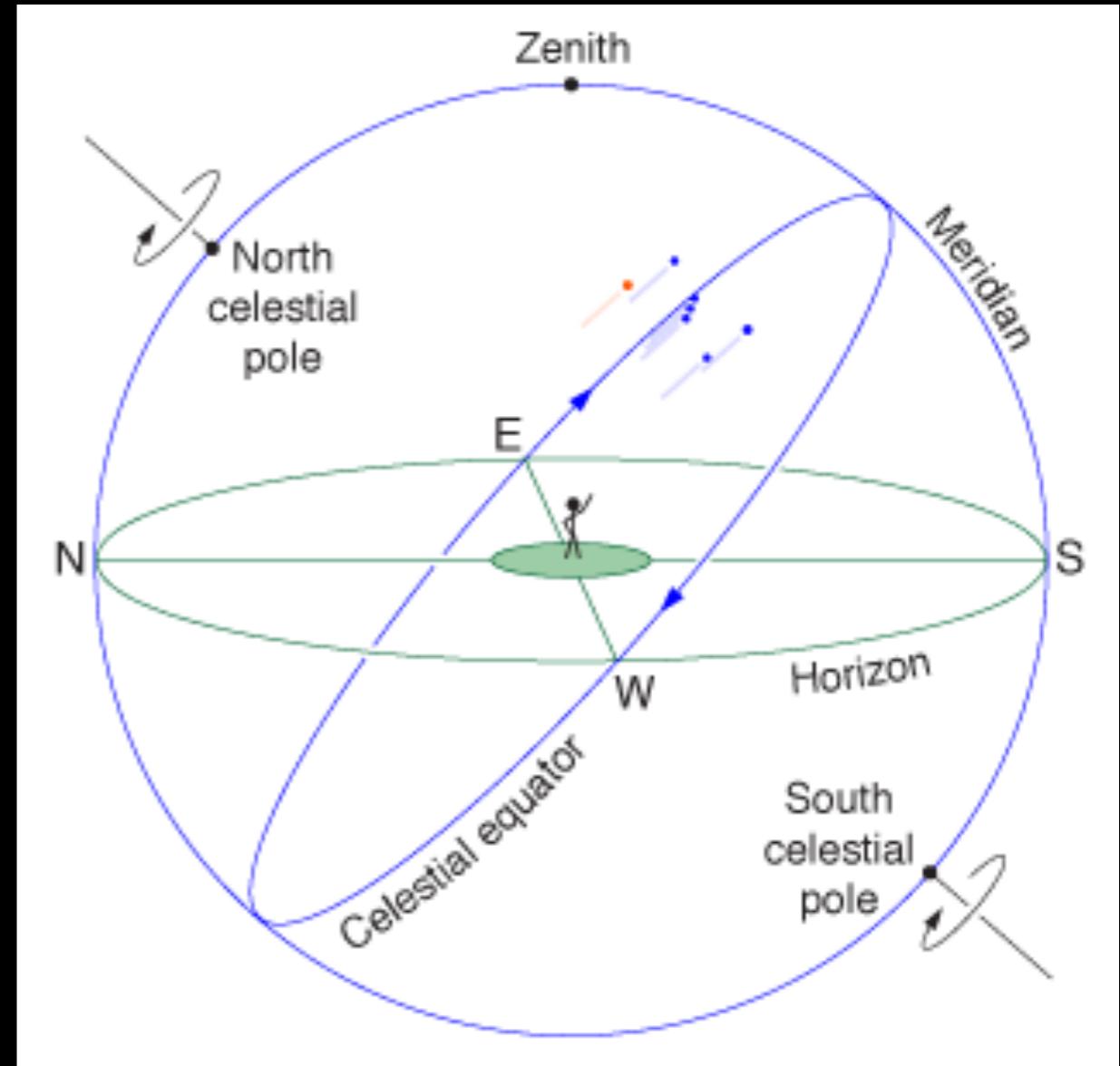
Azimuth - angle of star NE from N - 360° all around

*NOT the same thing as height from ground

The Celestial Sphere - these CHANGE depending on where you are

Celestial Equator
imaginary line in the sky
representing the projection
of the Earth's equator on to
the celestial sphere

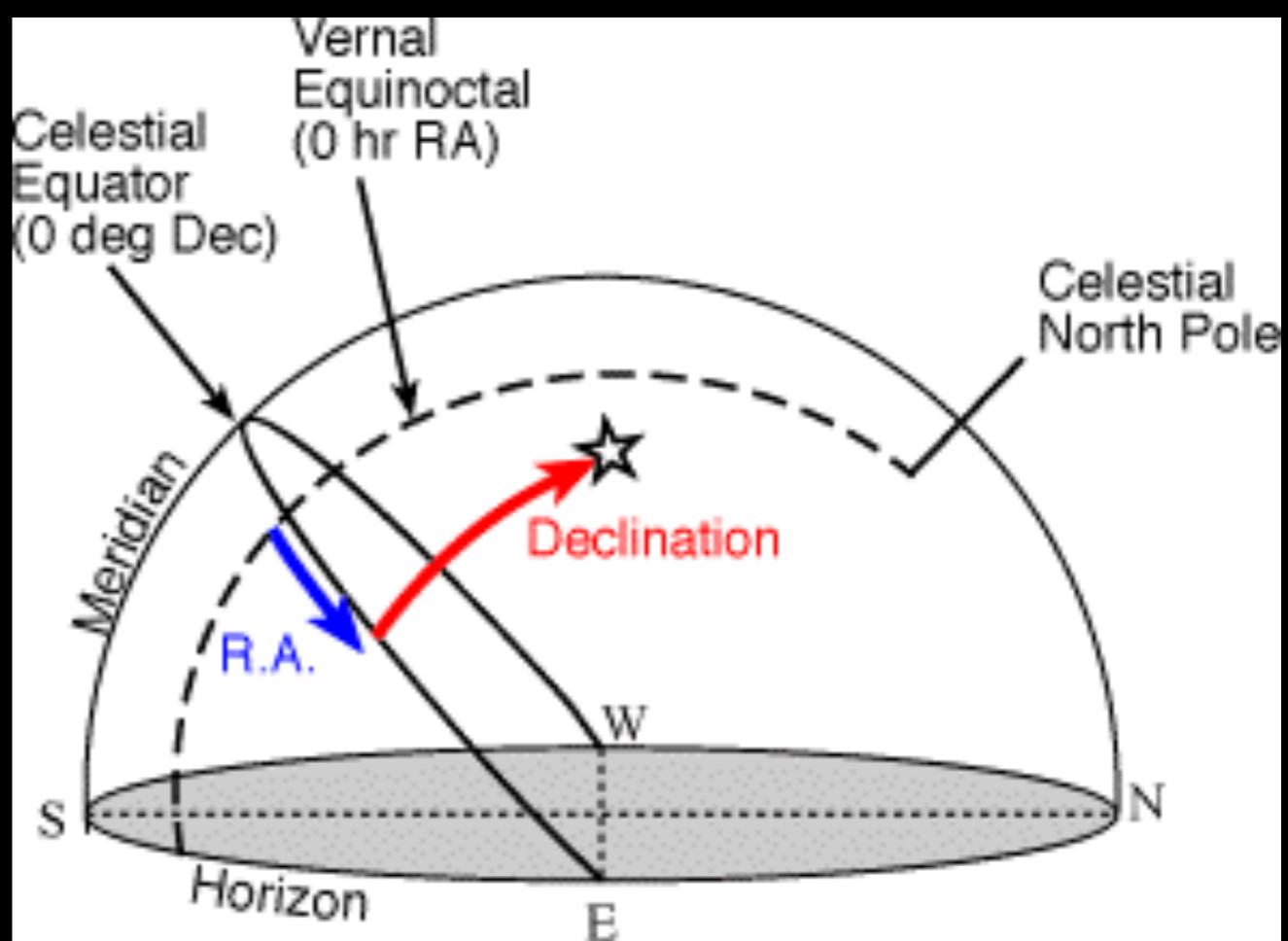
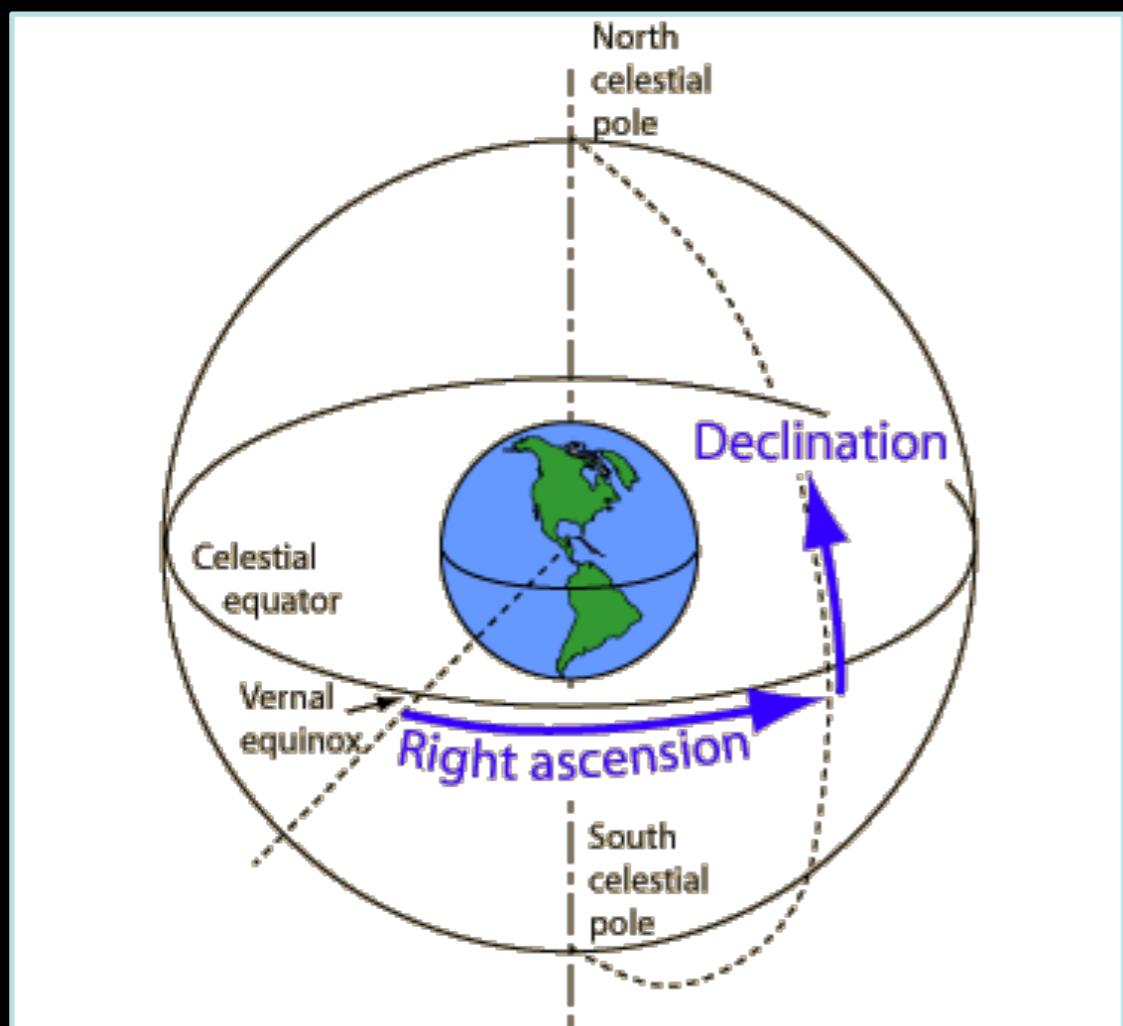
North/South Celestial Pole
imaginary points in the sky
which is the projection of
the north/south pole on the
night sky



The GLOBAL coordinates of objects are based on their location on the celestial sphere

Right Ascension - the angle of the star with respect to the vernal equinox (like longitude)

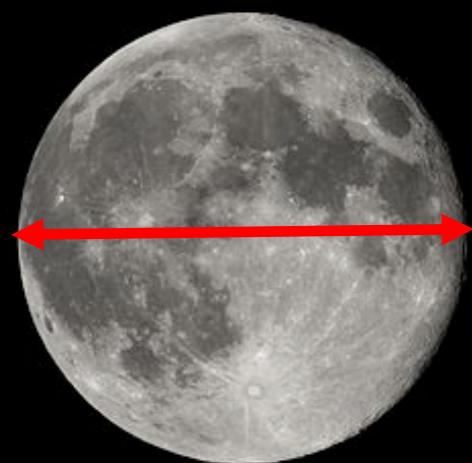
Declination - the angle of the star with respect to the celestial equator (like latitude)



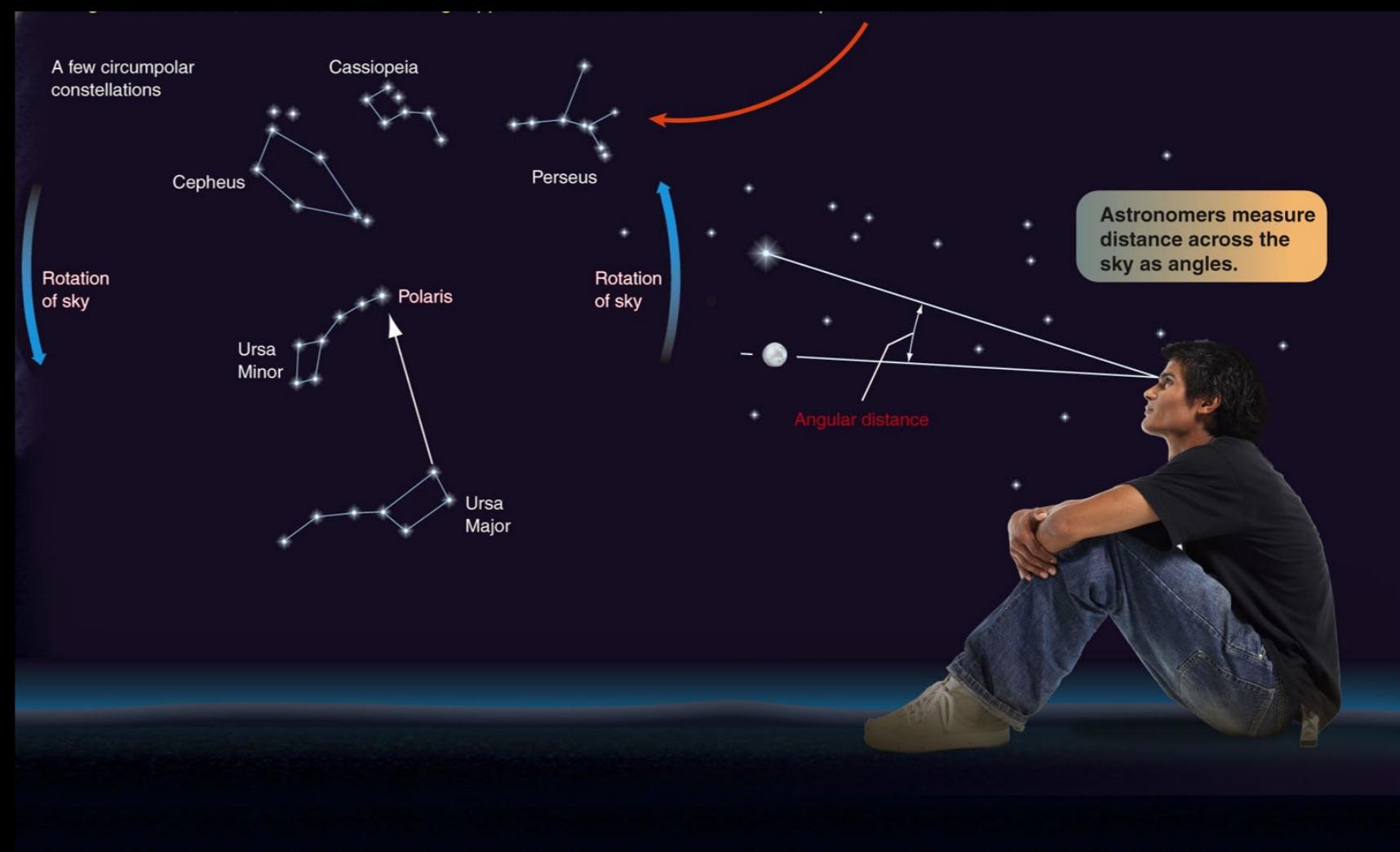
Same all over the globe!

We use angles to measure distances in the night sky

- These are expressed in units of degrees and subdivisions of degrees called arc minutes and arc seconds.



Moon is 0.5° across



Q: If you are at the _____ (north pole/equator/south pole), where is the location of the _____ (south celestial pole/celestial equator/north celestial pole) ?

- A)On the horizon
- B)Toward the East halfway up
- C)At your zenith/over your head
- D)Not visible/below your feet

A Tour of the Winter Night Sky

Night sky tools:

Old School - www.skymaps.com

New School - ipad, iphone or tablet app or software

Apps: GoSkyWatch

Night Sky

Sky Map - Android

Pocket Universe