

# Welcome to *Astronomy 115*

<http://sdbv.missouristate.edu/mreed/CLASS/A115>

**“If at first you don’t succeed, then skydiving  
definitely isn’t for you.”**

**Anonymous**



**The Earth is roughly spherical (round in 3 dimensions)**

**Methods for proving this might include: using oceans (boat over the edge), flying around it, leave a string (unique solution?), satellite pictures from many angles.**

# What is science?

Google says, “the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment.”

more concise (by me):

understanding the world around us using observations, experiments, and deductive reasoning.

What is the scientific method?

A way to distinguish between ideas (theories/hypotheses) to determine which is likely correct.

# The scientific method

- Do an experiment or make an observation.
- Determine an explanation (theory) for the observation.
- From the theory, make predictions.
- Make further observations to test the prediction.
- Eliminate or refine the theory.

# How is science done?

“science” uses evidence to understand/infer how nature/the world/the Universe works.

# The easy questions

How big is the Earth?

How far away are the Sun and  
Moon?



# A picture of our solar system.

Order by size:  
Earth, Moon, Sun, Stars, Comets, Planets







# A picture of our solar system.

Order by size:  
Earth, Moon, Sun, Stars, Comets, Planets

How could you determine these sizes?

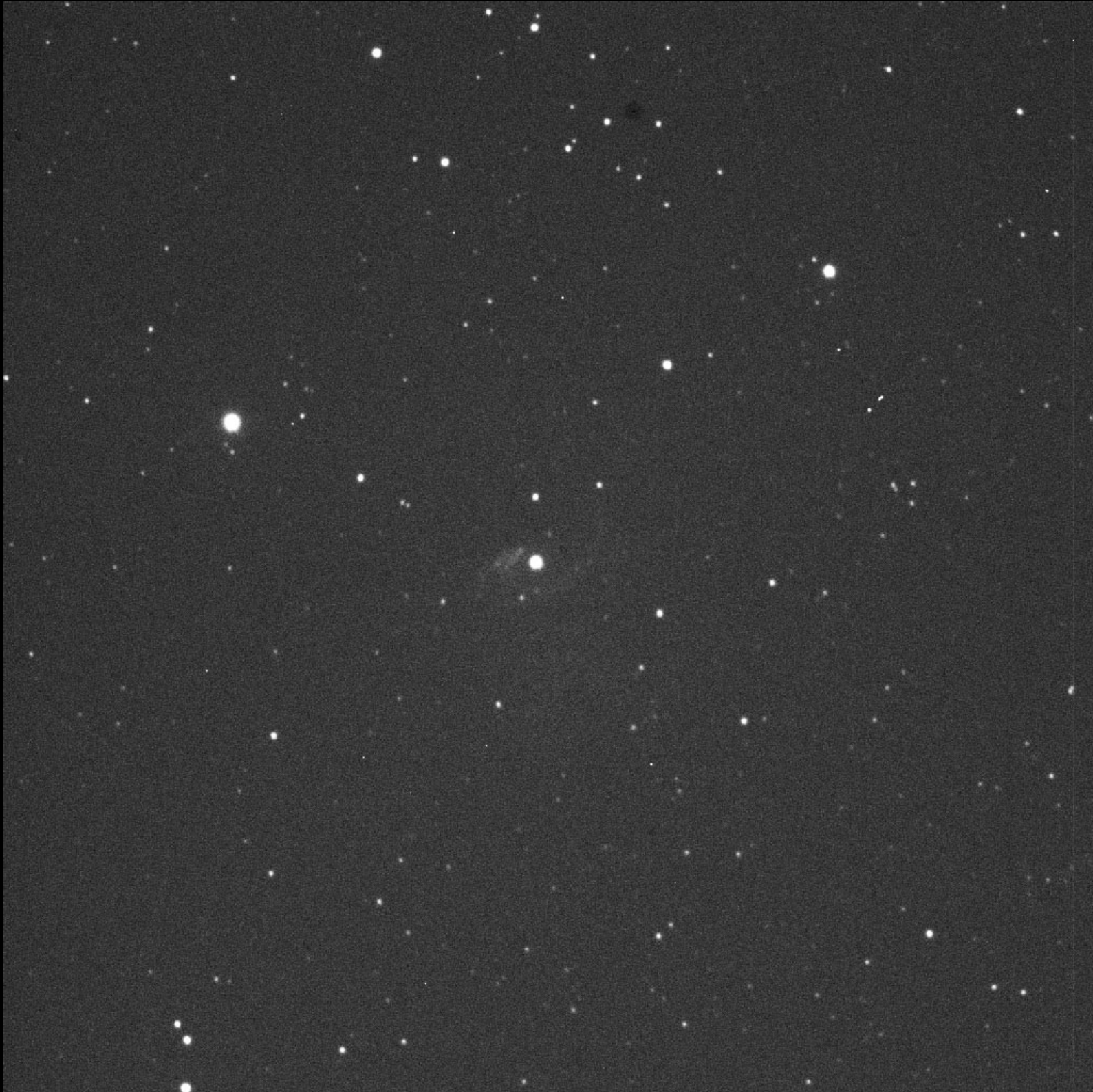




**What is at the center of our solar system?**



If you could take a rocket outside of our solar system, what do you think you would see?



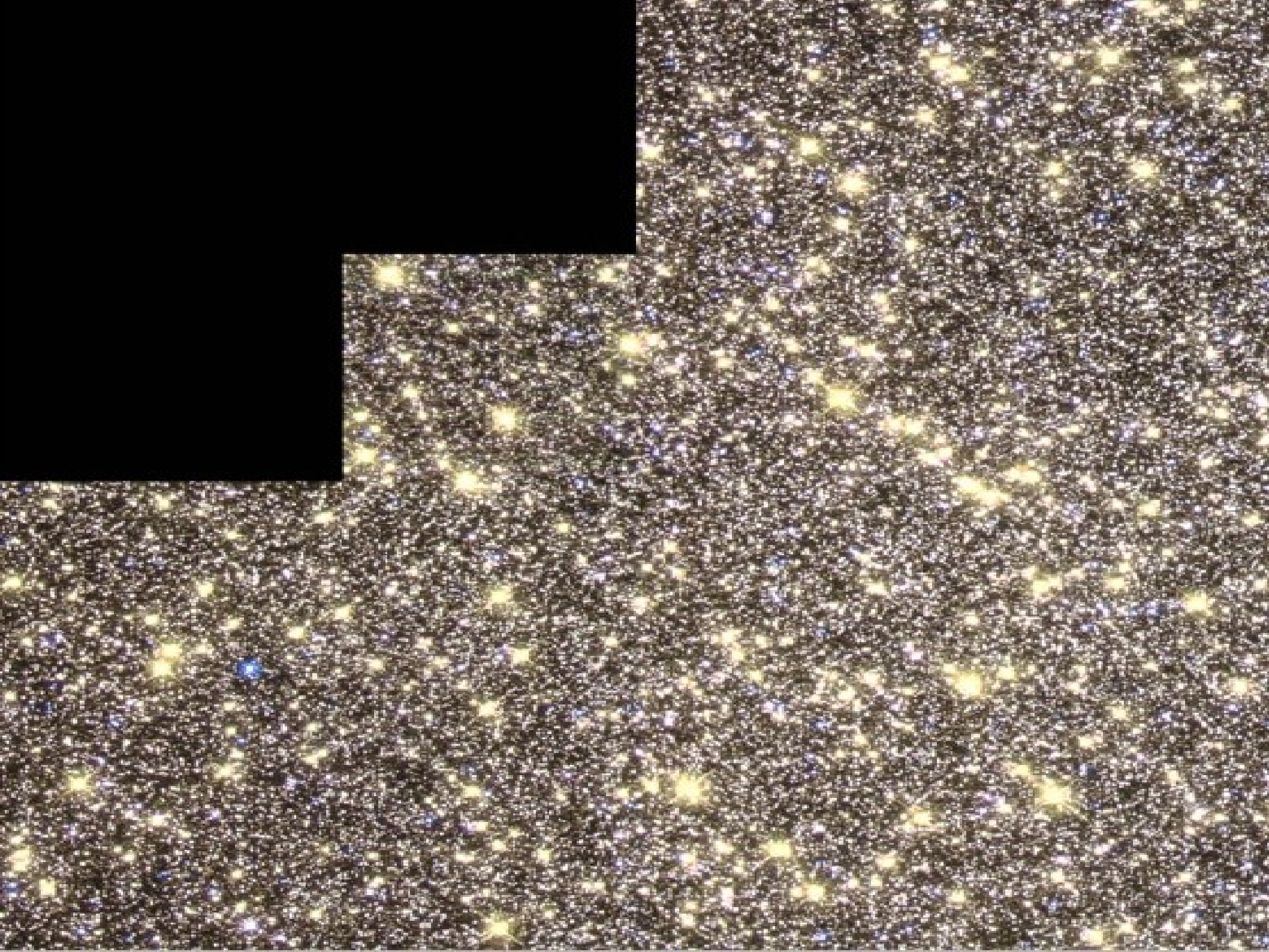


Space is both incredibly empty and  
yet full.





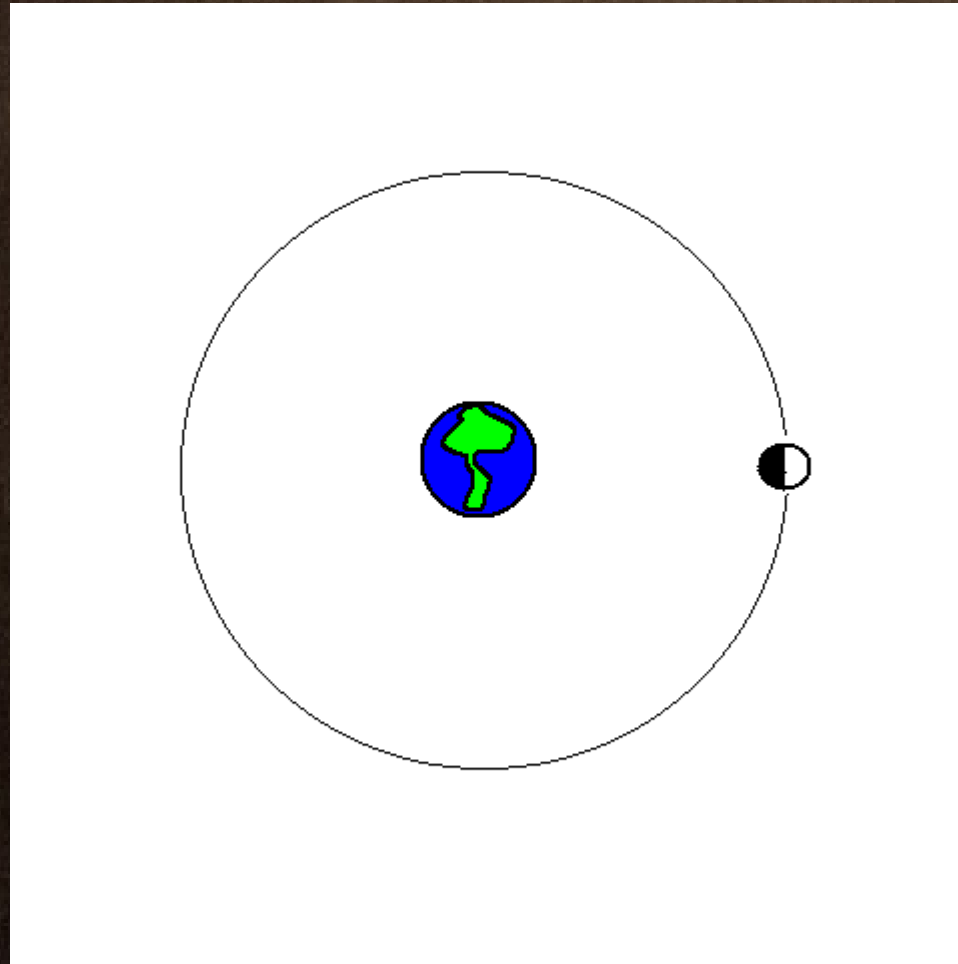




We begin by examining what we  
know about the Earth and the Moon

If you were far above the Earth's north pole and looked down and watched the Moon, what would you see?

The Moon goes **around** the **Earth!**



**Much faster than the Earth goes around the Sun.  
The Moon orbits once about every 28 days.**

# The Moon goes around the Earth!



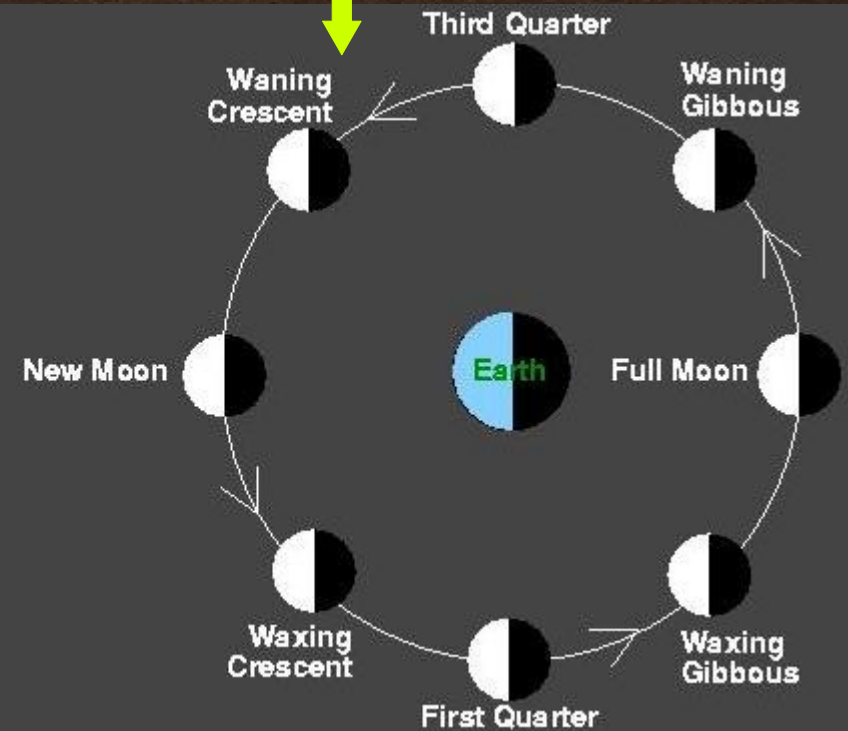
**Moon phases will be covered in lab, week 2.**

**Phases of the Moon are NOT  
caused by the Earth's  
shadow. The Moon is always  
half-lit by the Sun. Phases  
are caused by the portion of  
the lit side of the Moon that  
is visible to us.**

How the Moon appears to us on Earth



How it would appear if you were a bazillion miles above the north pole



# Lunar Orbit.

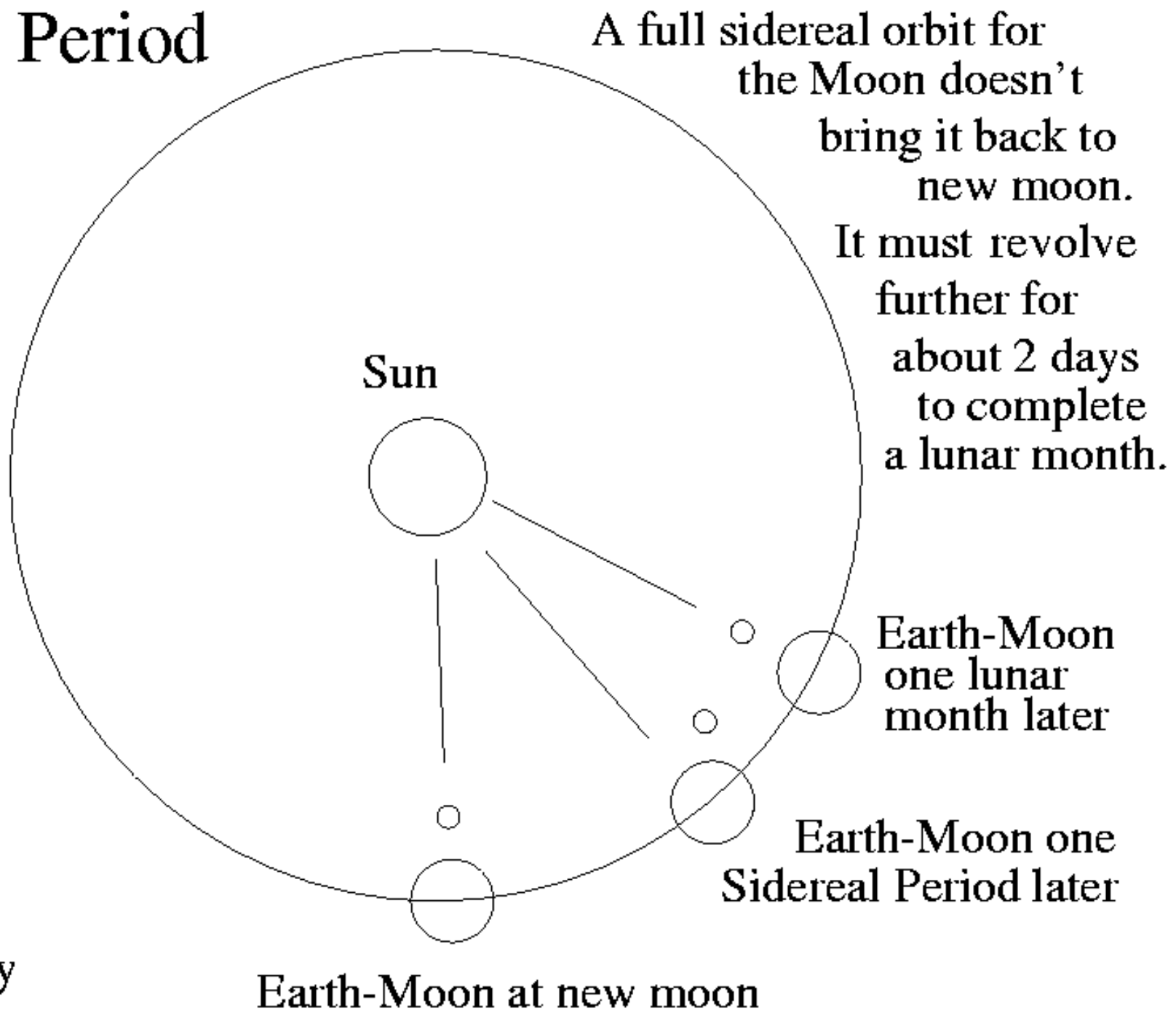
**We see a Full Moon once every 29.5 days.**

**But the Moon actually goes around the Earth once every 27.3 days!**

**Why are these numbers different?**



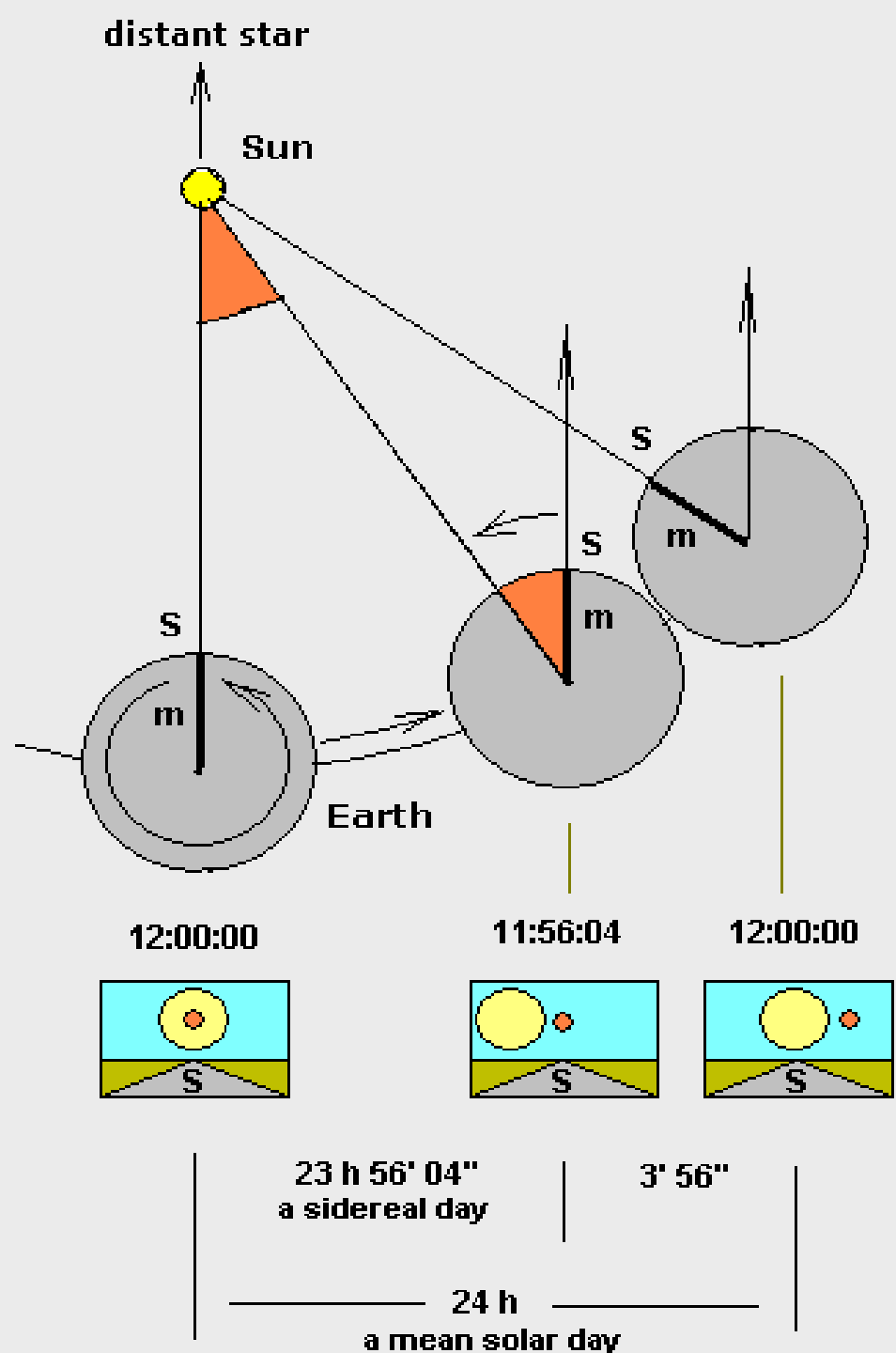
# Sidereal Period and Lunar Month



DJ Jeffery

UNLV 2003

The same is true for an Earth day! If you keep time by the stars, your sidereal day is different from the solar day by nearly 4 minutes.



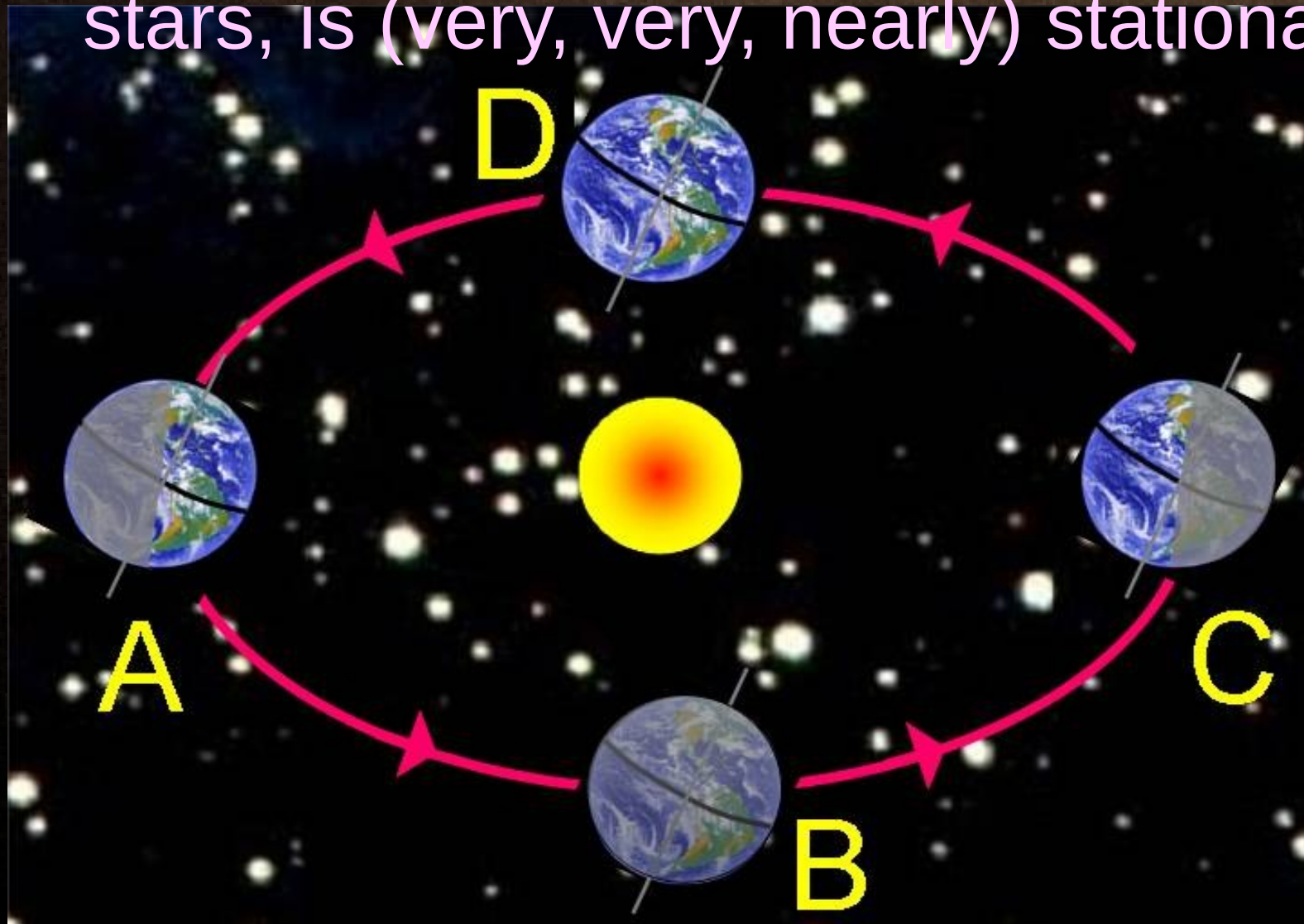
# Definition: Sidereal vs Solar

Sidereal: One complete revolution according to the stars.

Solar: One complete revolution according to the Sun.

This will be very funky for some planets!

The Earth only goes around 1 star, our Sun. **Other stars are much farther away.** The position of the Earth relative to the Sun changes during the year, but our solar system, compared to other stars, is (very, very, nearly) stationary.



# Eclipses

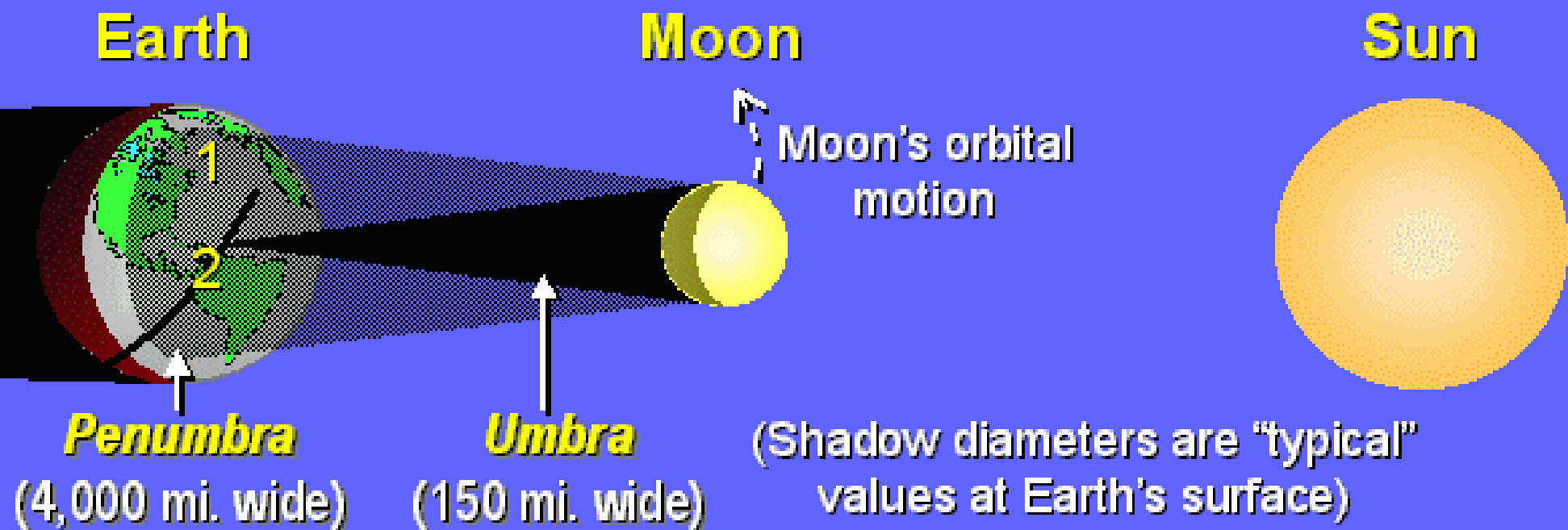
**Solar Eclipse:** The Moon is between the Sun and the Earth. Can only occur during New Moon. The Moon's shadow only covers small regions of the Earth.

**Partial Eclipse:** The Moon only covers part of the Sun.

**Lunar Eclipse:** The Earth is between the Sun and the Moon. Can only occur during Full Moon. Can also have partial eclipse.

# Total Eclipse of Sun

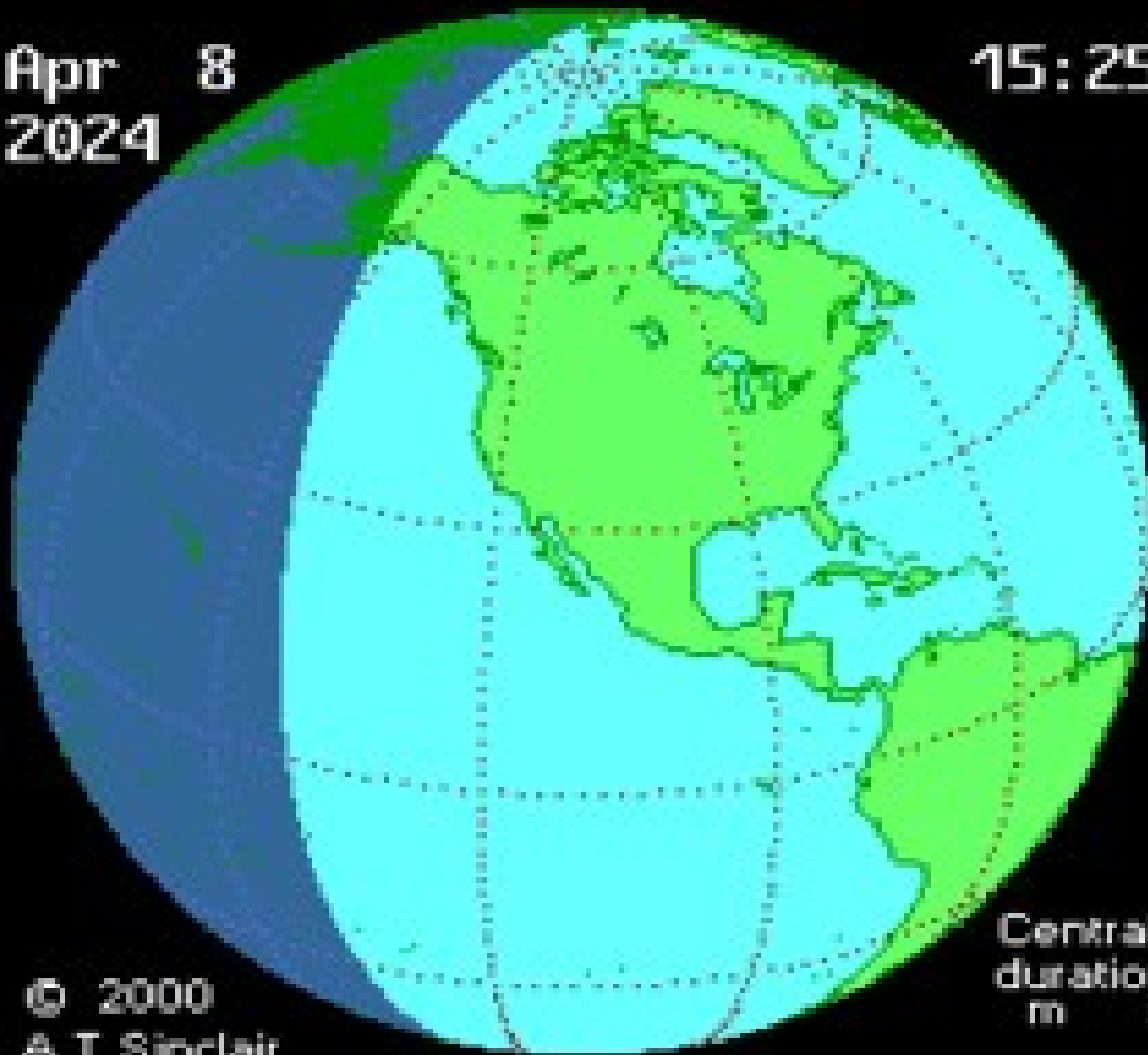
Shadow path on Earth's surface results from combined motions of Earth and Moon



Above drawing  
not to scale

Apr 8  
2024

15:25



© 2000  
A. T. Sinclair

Central  
duration  
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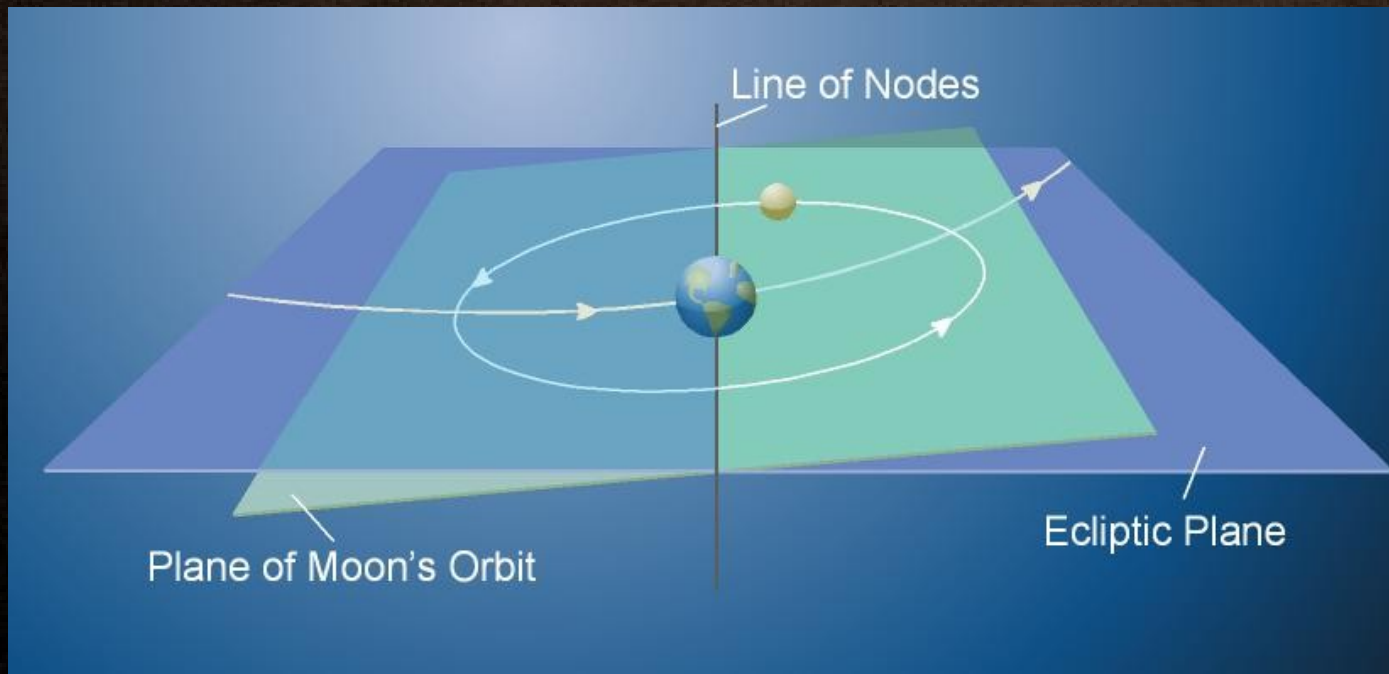
[sunearth.gsfc.nasa.gov/eclipse](http://sunearth.gsfc.nasa.gov/eclipse)

why don't solar and lunar  
eclipses happen once  
every lunar orbit?

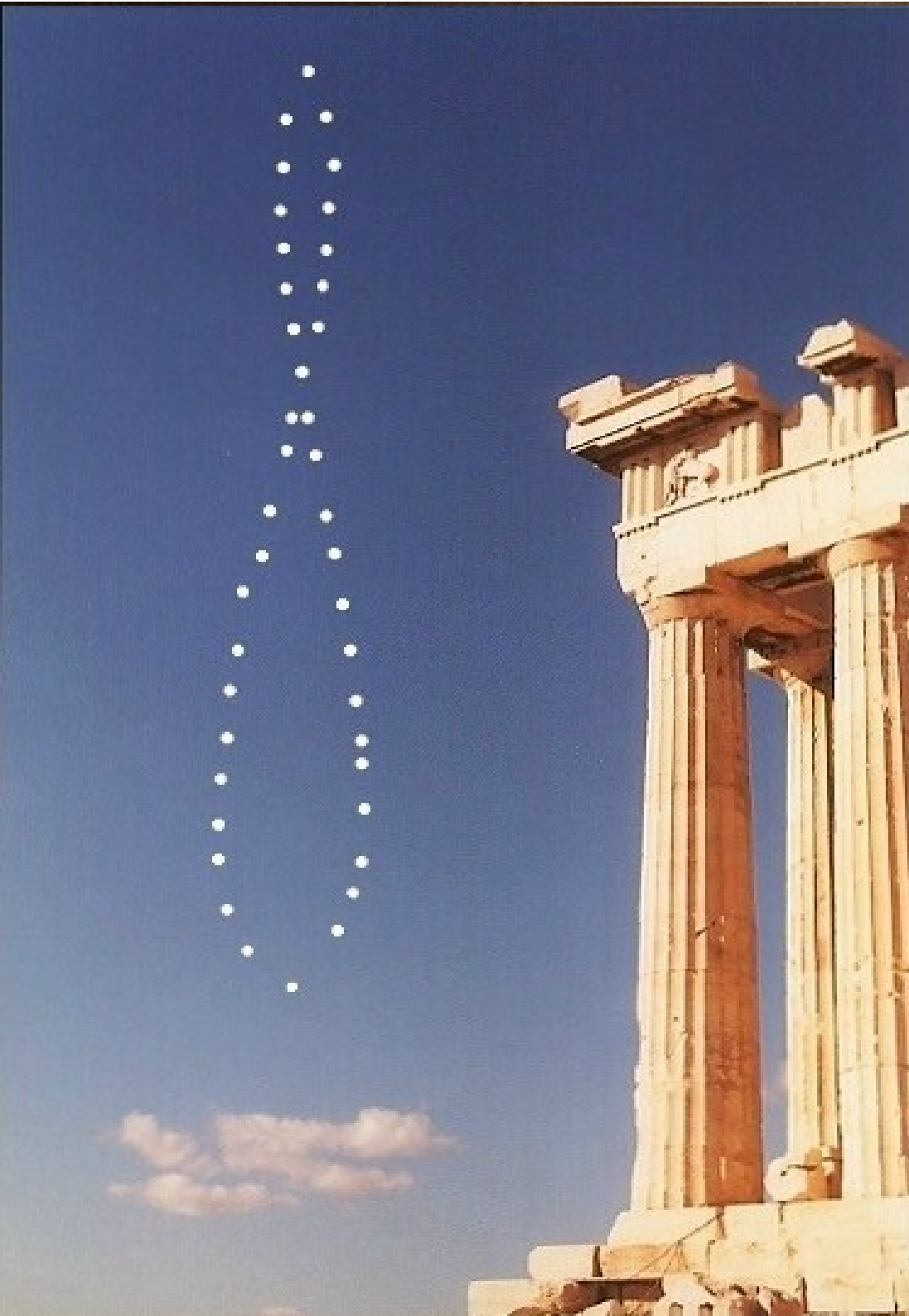


# why don't solar and lunar eclipses happen once every lunar orbit?

Because the Moon's orbit is tipped compared to the Earth's. An eclipse only happens if a New or Full Moon occurs when the Moon is on the Earth's orbital plane (called the **ecliptic**).







If you took a picture of the Sun every day at noon. You would get something like this.

# Earth's Seasons

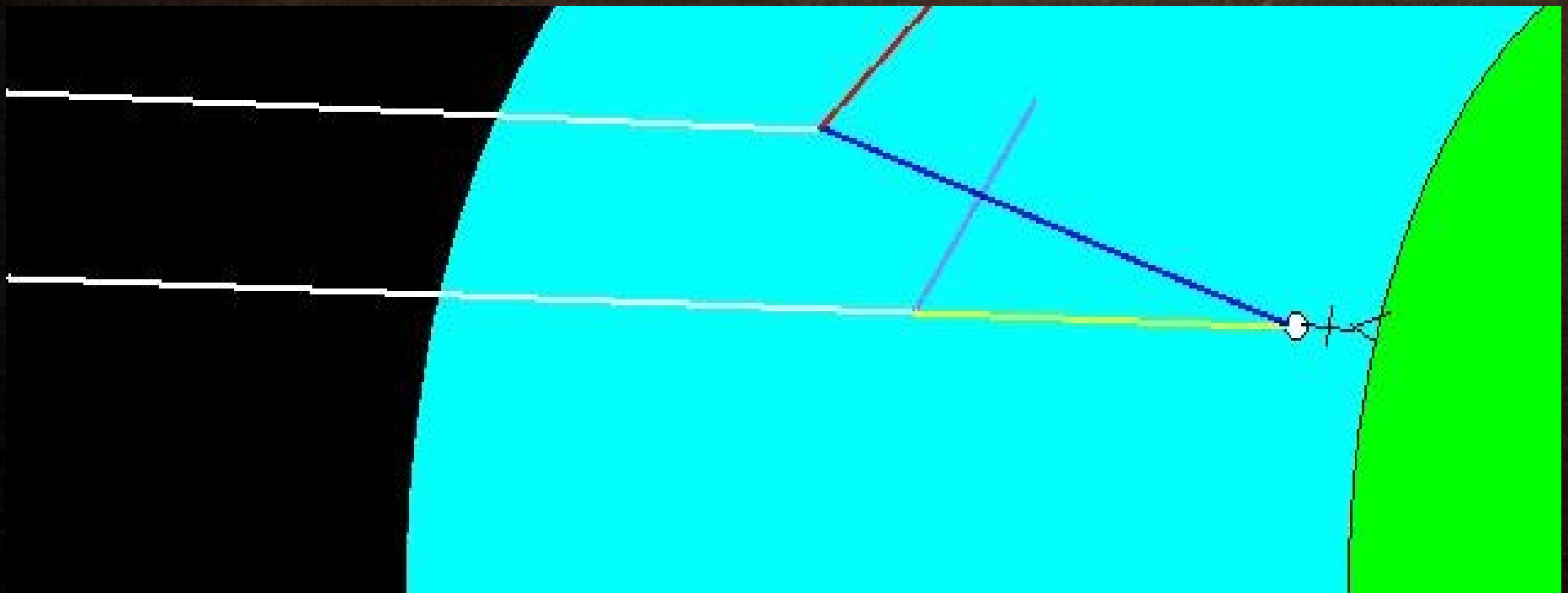
We all know that summers are hotter than winters- why?

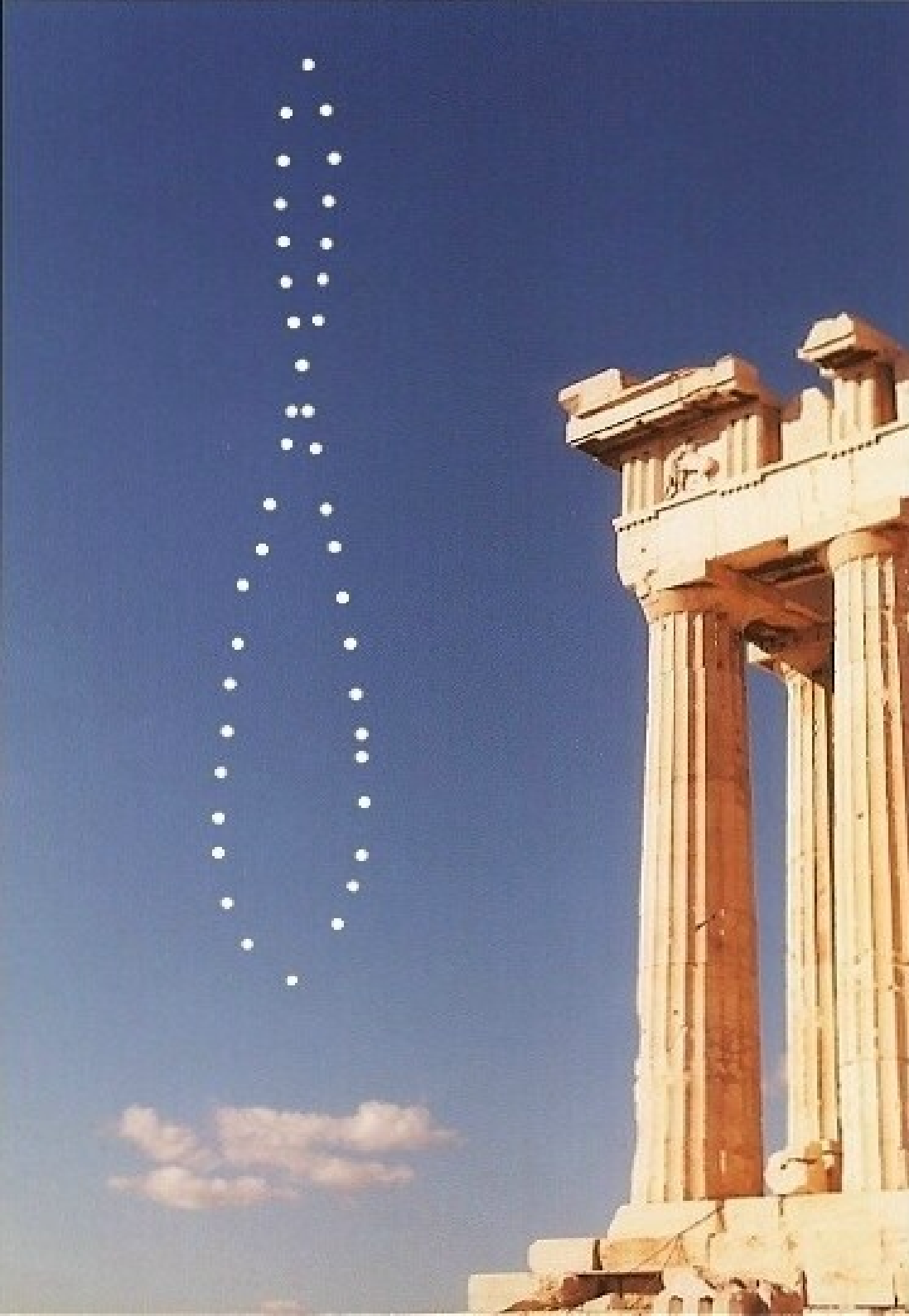


# Seasons

- **Determined by:**
  - **Length of day** (longer day, more Sunlight to provide heat)
  - **How direct the sunlight** hits the surface.
  - **How much atmosphere** light has to go through.
    - Atmosphere refracts light (especially blue, thus the color of the sky)
    - The Sun appears orange at sunset because all the blue light is refracted, leaving only the red part.

Sunlight is made up of all the colors of the rainbow. When combined, this produces white light. But Earth's atmosphere refracts (deflects) certain colors more than others. Thus the Sun appears yellow and the sky appears blue.





## Terms

- Equinox: Sun is over the equator
- Solstice: Sun is as far north/south as it gets. (23.5 degrees)
- Ecliptic: Plane in which the Earth orbits the Sun

# The start of a season

## Vernal Equinox

- The Start of our modern astronomical calendar
- The sun is directly over Earth's equator in the springtime.
- Equal daytime and nighttime.

## Summer Solstice

- The Sun is at it's point farthest north (directly over the Tropic of Cancer)
- Longest day in the Northern Hemisphere. Longest night in the Southern Hemisphere

## Autumnal Equinox

- The Sun is directly over the Earth's equator again.

## Winter Solstice

- The Sun is at it's point farthest south (over the Tropic of Capricorn.)
- Shortest day in the Northern Hemisphere, longest day in the Southern Hemisphere.

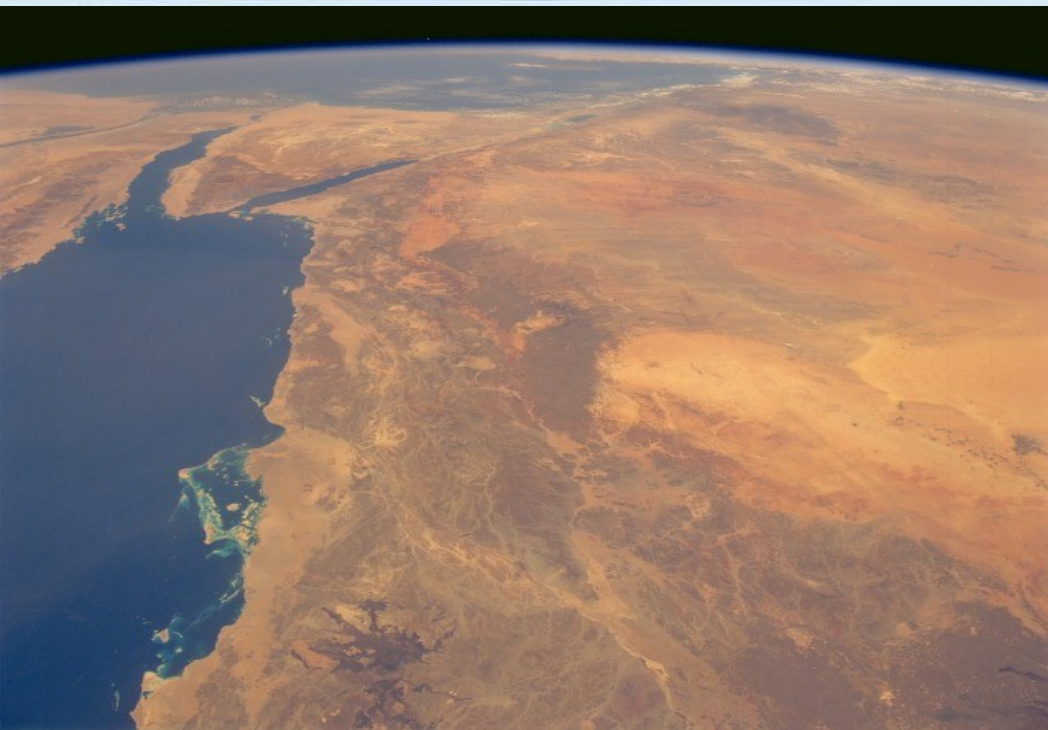


# Baseline: The Earth and Moon



From this picture,  
right down what you  
see and what it  
tells us about the  
Earth





Same here.