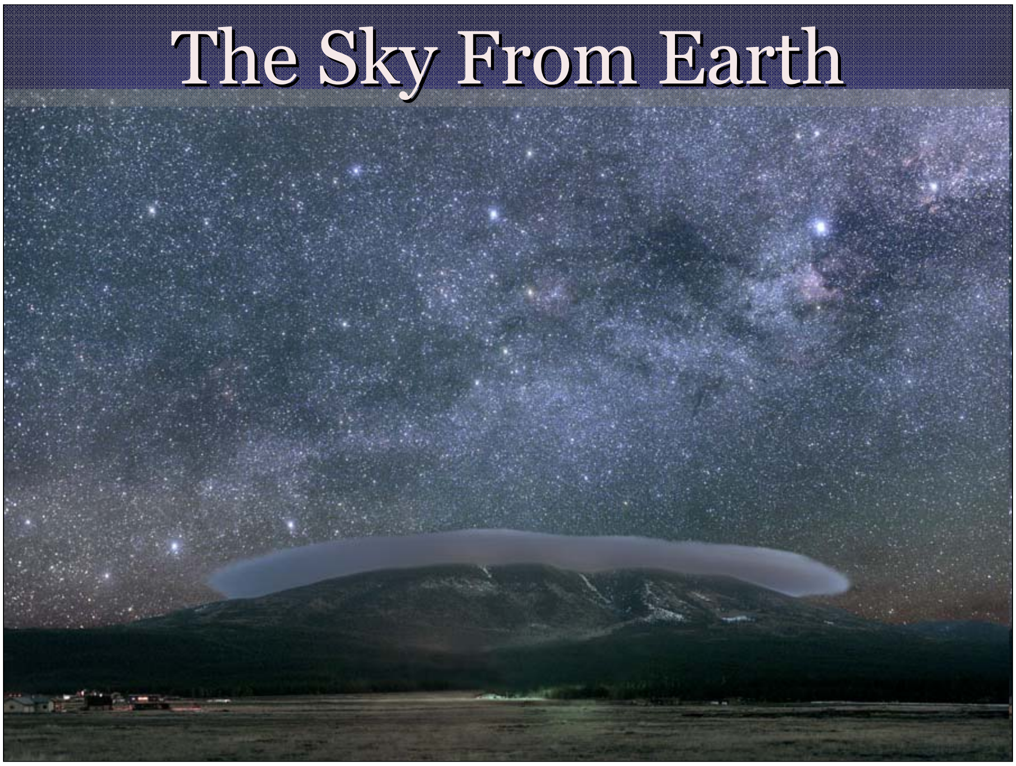


We walk outside and look into the sky.

What do we see?

How does our view change with time?

Why?

We're in St. Paul Minnesota, it's close to noon, we turn to face the Sun.

What direction (approximately) are we facing?

How do you know?

Why is the Sun in that direction?

Is that true for everyone on Earth?

Where are the stars?

Why can't we see them?

So- The ground is below us.

The sky appears to be a great dome above us.

The sky and the ground meet at the horizon.

What's the deal with the Horizon?

How "far" can we see?

What fundamentally limits how far the horizon extends.

We’re in St. Paul Minnesota, it’s winter, the sun is setting, we turn to face the Sun.

What direction (approximately) are we facing?

What direction EXACTLY are we facing?

Why is the Sun in that direction?

Is that true all the time?

What about in the summer, say on June 21st.. What direction is sunset?

Night time, facing South.

We see Orion high in the southern sky. The bright red star is Betelgeuse, or Alpha Orion

The brightest stars in a given constellation are given Greek letters, the brightest is Alpha, second brightest is Beta and so on.

Astronomers use constellations to divide up the sky.

Sirius, or Alpha Canis Majoris, is the brightest star in the sky.

But... Betelgeuse is really a MUCH brighter star. **So why does Sirius appear so much brighter to us?**

It's REALLY hard to measure the distance to the stars. It took us a very long time to figure it out.

So when we look at the sky at night, we perceive a two dimensional dome upon which the stars are imprinted

The horizon appears to extend allllll the way to the dome of stars. Of course it doesn't because the Earth is really a tiny speck of dust.

How do the stars move in time?

Facing south, they arc across the sky reaching their highest point due south of us.

Facing north, they travel in circles around Polaris, the “North star”

Notice that some stars in the north NEVER set. They just travel in circles around the North Star. These are called circumpolar.

Facing west, the stars follow a slanting path “down” and “north” as they “set” below the western horizon

Facing east, the stars follow a slanting path “up” and “south” as they “rise” above the eastern horizon.

So- What’s REALLY going on?

The Earth is turning. We’re fixed to the surface. Our UP is constantly changing.

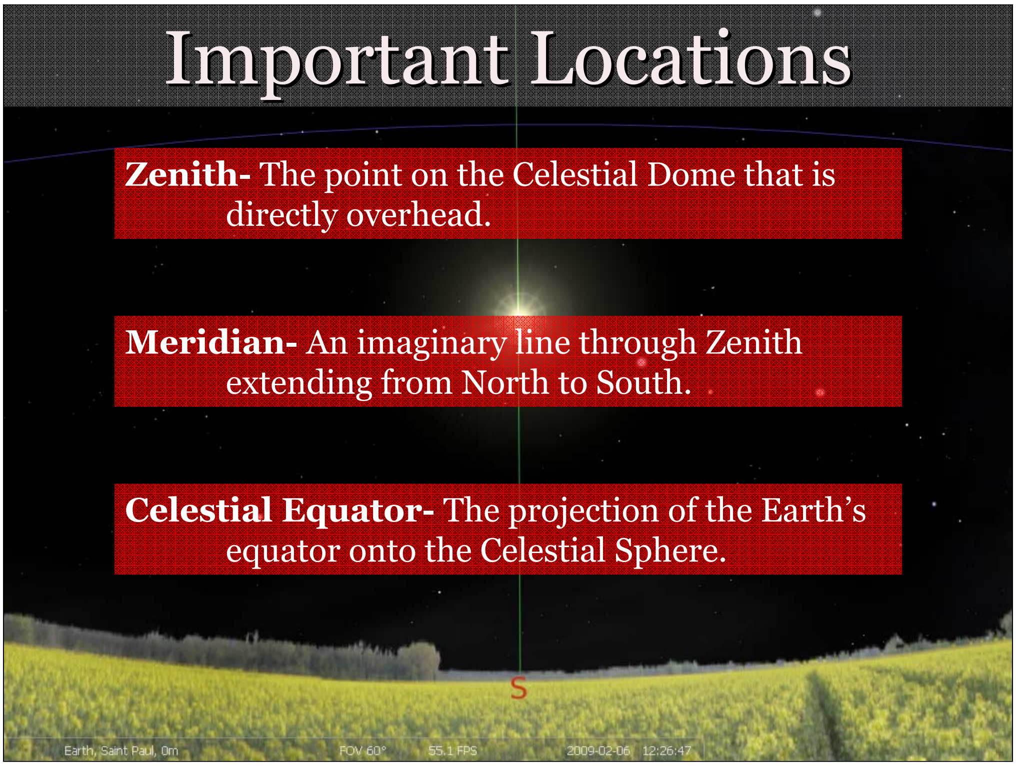
When we look at a fixed point with respect to the Earth, the sky changes.

Really, the sky is motionless and we are moving.

If we imagine celestial lines of longitude and latitude parallel to those on the Earth projected onto the celestial sphere, we can see what’s going on.

We appear to be inside of a sphere called the “Celestial Sphere”

The celestial sphere appears to be rotating on an axis that is aligned with the poles on the Earth



Is Zenith always at the same spot (among the same stars) in the sky? Why not?

How about if we look at the stars at the same time (Say midnight) every night over several months.

Can ANY star appear at Zenith? Why not?

What's special about the Meridian?

A star is at it's HIGHEST POINT in the sky when it crosses the meridian.

What's special about the Celestial Equator?

Stars ON the celestial equator rise due east, arc through the southern sky, and set due west.

Stars SOUTH of the celestial equator rise and set south of west

Stars NORTH of the celestial equator rise and set north of west.

Stars that are too far NORTH of the celestial equator never set

Stars that are too far SOUTH of the celestial euqator never rise

What happens when we change lattitude?

So… Facing South, the stars move “up”

Facing North the stars move “down”

What’s going on?

When we change Latitude, our local zenith is pointing somewhere else in the sky.

Our horizon tilts North to South so that we’re looking at a different celestial hemisphere

How can we determine our Latitude?

ABCD

A long exposure photograph shows the stars moving in perfect circles around zenith. (the stars neither rise or set). You are:

A. In Orbit

B. At the Earth’s equator

C. At one of the Earth’s poles .

D. At Gerry’s House

ABCD

A long exposure photograph shows the stars are rising and setting perpendicular to the horizon and traveling in large arcs.

A. In Orbit

B. At the Earth's equator

C. At one of the Earth's poles .

D. At Gerry's House

What happens when we change the date? Say… skip ahead 6 months?

Hmm… Orion is close to the Sun now?

What's going on?

What is the period of time called when the Sun comes back to meridian?

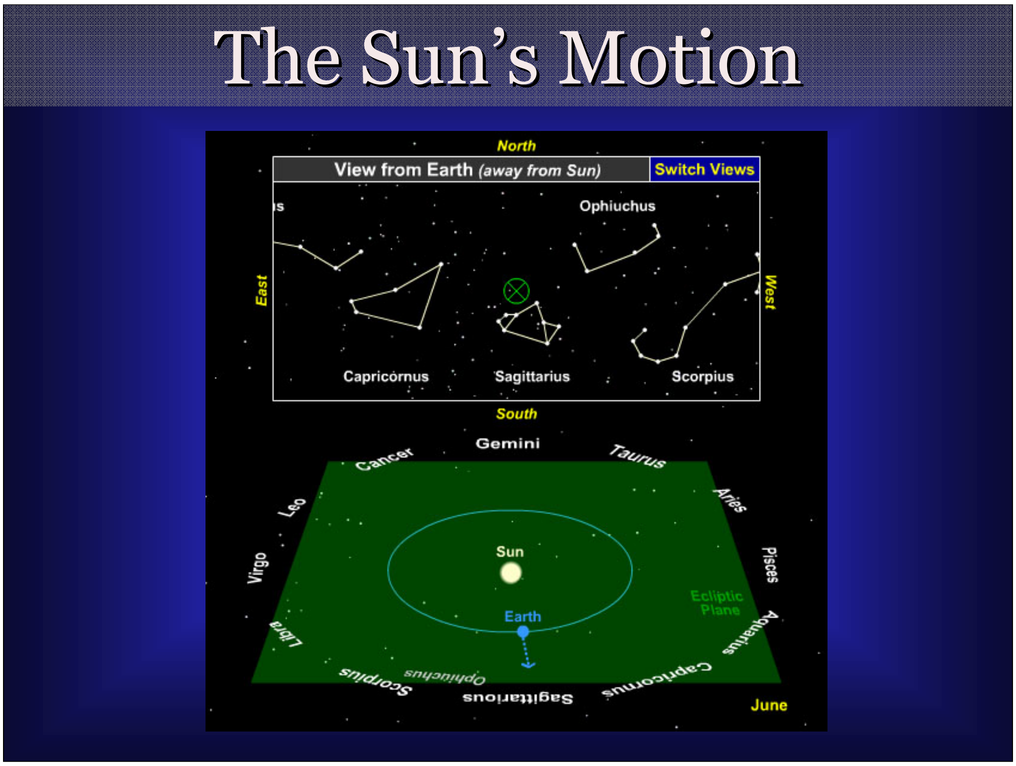
"Solar Day"

When the stars are back in their original positions… It's called a **Sidereal Day.**

Let's look at the Sun over the course of a year.

It follows the "ecliptic"

Why does it's apparent position among the background stars change?



An animation showing how the position of the Earth in its orbit around the Sun effects the stars that are visible at night.

Also in Stellarium, as we move ahead one solar day at a time, the Sun appears to move from below (south of)

the celestial equator to above (north of) it.

Notice also the unusual movement of Jupiter. (and of Mars if we can catch it in the act)

During northern hemisphere winter, the Sun appears SOUTH of the Celestial Equator.

During northern hemisphere summer, the Sun appears NORTH of the Celestial Equator.

This is due to the tilt of the Earth’s axis with respect to the Ecliptic.

In the northern hemisphere summer, a line between the center of the Sun and the center

the Earth pierces the Tropic of Cancer (23 degrees north latitude)

In the northern hemisphere winter, a line between the center of the Sun and the center

the Earth pierces the Tropic of Capricorn (23 degrees south latitude)

At the Equinoxes, a line between the center of the Sun and the center

the Earth pierces the Equator.

ABCD

Stars that can be seen all year are:

A. Near the Celestial Poles

B. Near the Celestial Equator

C. Near the Sun.

D. No stars can be seen all year.

ABCD

At Summer Solstice, the direction of sunsets is:

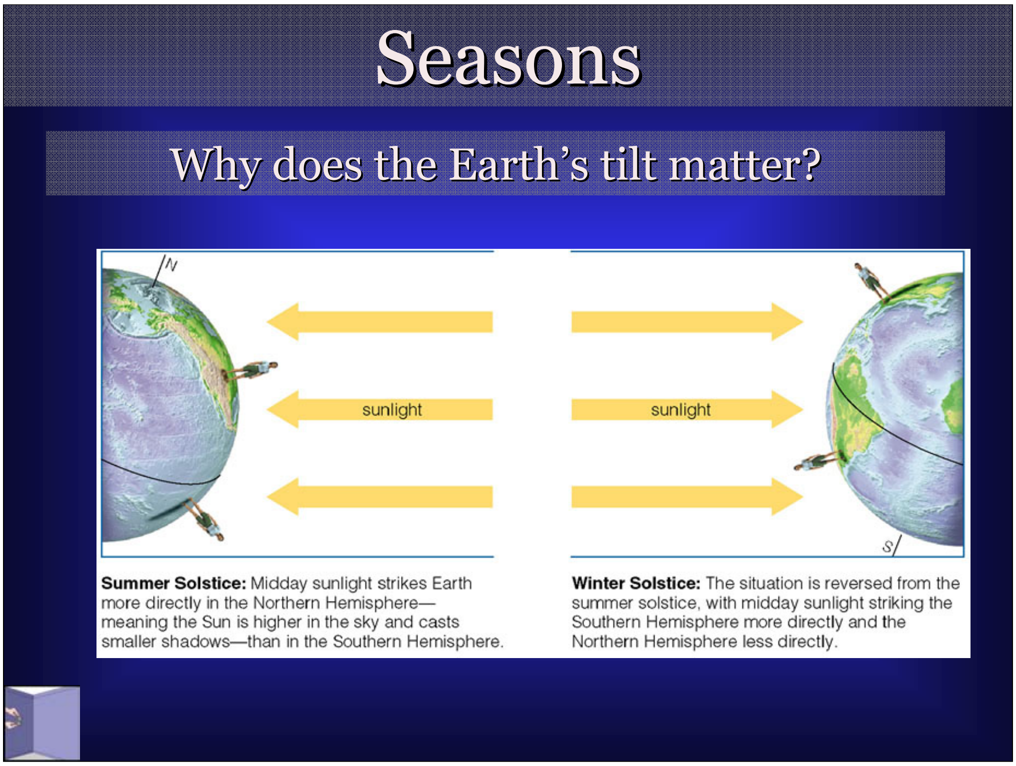
A. Directly West

B. Directly East

C. North of West or East

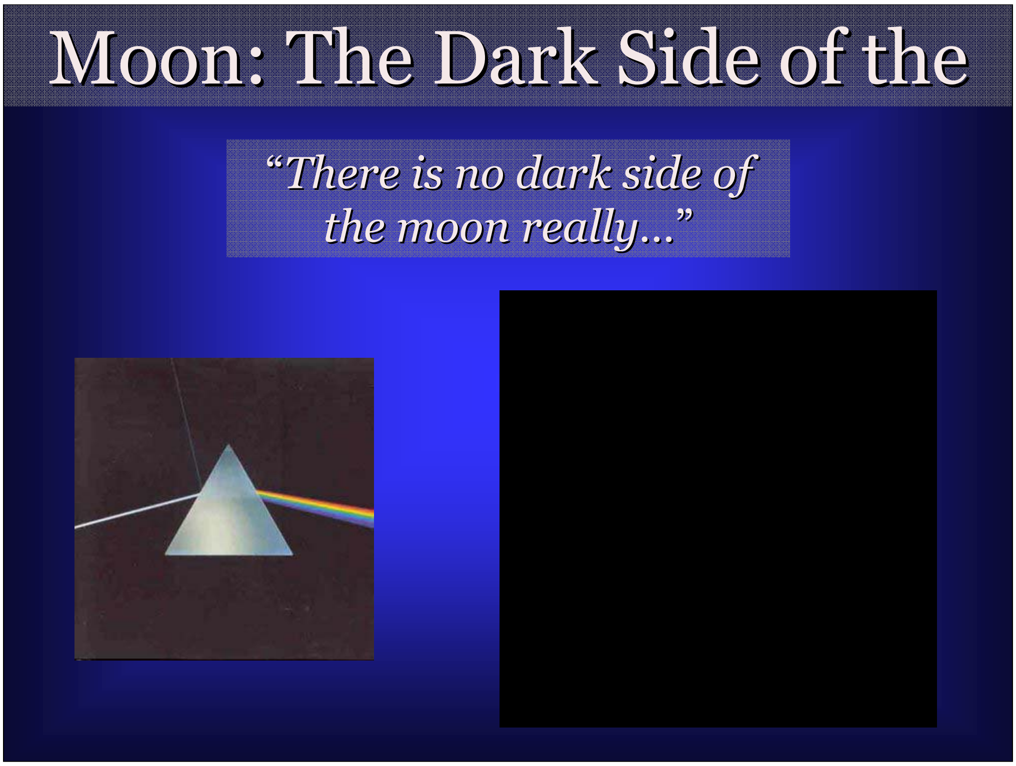
D. South of West or East

What’s the reason for the Season’s?



What's the reason for the Seasons?

In class discussion… Take good notes.



At last there's not PERMANTENTLY dark side of the Moon.

The Moon has day and night just like the Earth.

The odd thing is that it always keeps the same face towards us.

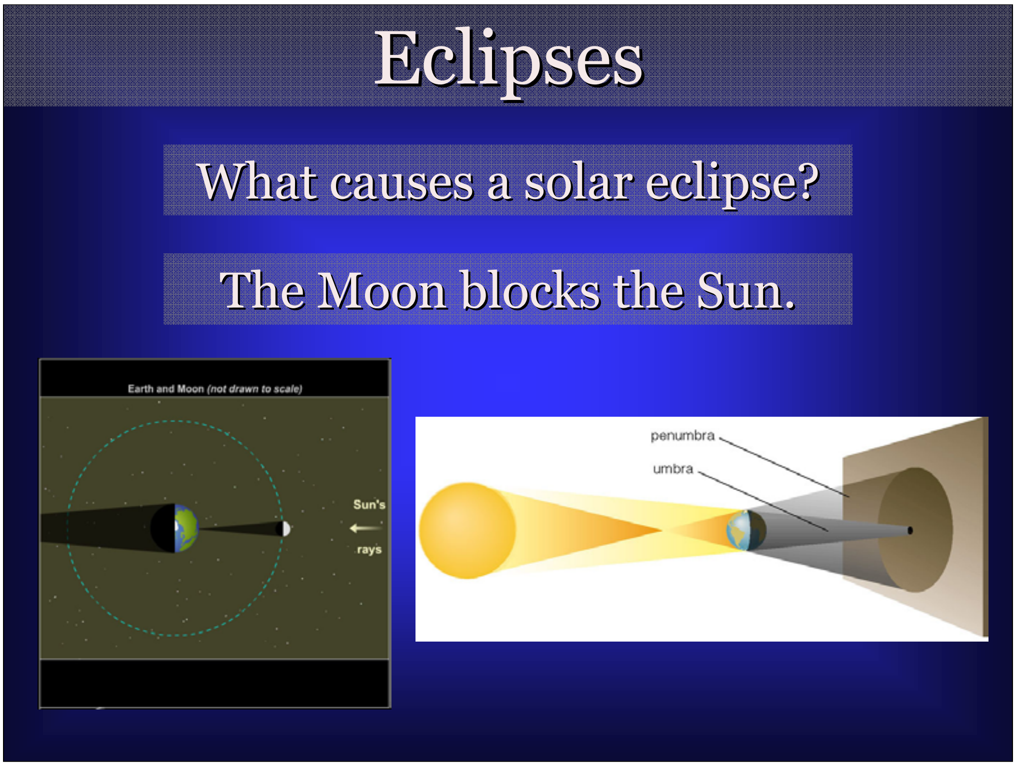
So- there is a FAR side of the Moon.

The far side of the Moon hadn't been seen by human beings until the Apollo Missions.

The animation shows one complete lunar day as seen from the Earth, called a "Lunation"

Notice that we ALWAYS see roughly the same side.

What's up with Moon Phases anyway?



A solar eclipse happens when when the Moon blocks your view of the Sun.
A lunar eclipse happens with the Earth blocks the Moon’s view of the Sun.

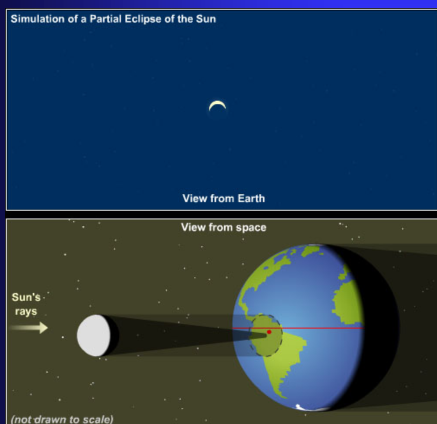
If your view is COMPLETELY blocked, you are in the UMBRA
If your view is PARTIALLY blocked, you are in the PENUMBRA

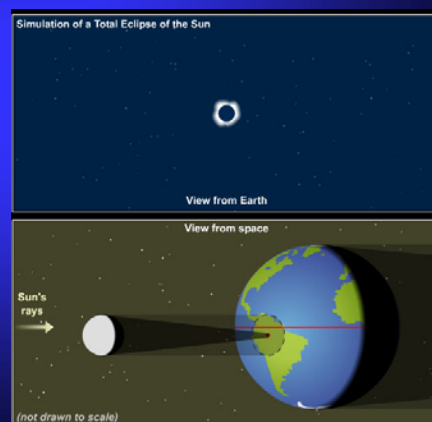
You are in the penumbra when you can see part of the sun around the moon.
You are in the umbra when the entire sun is blocked.

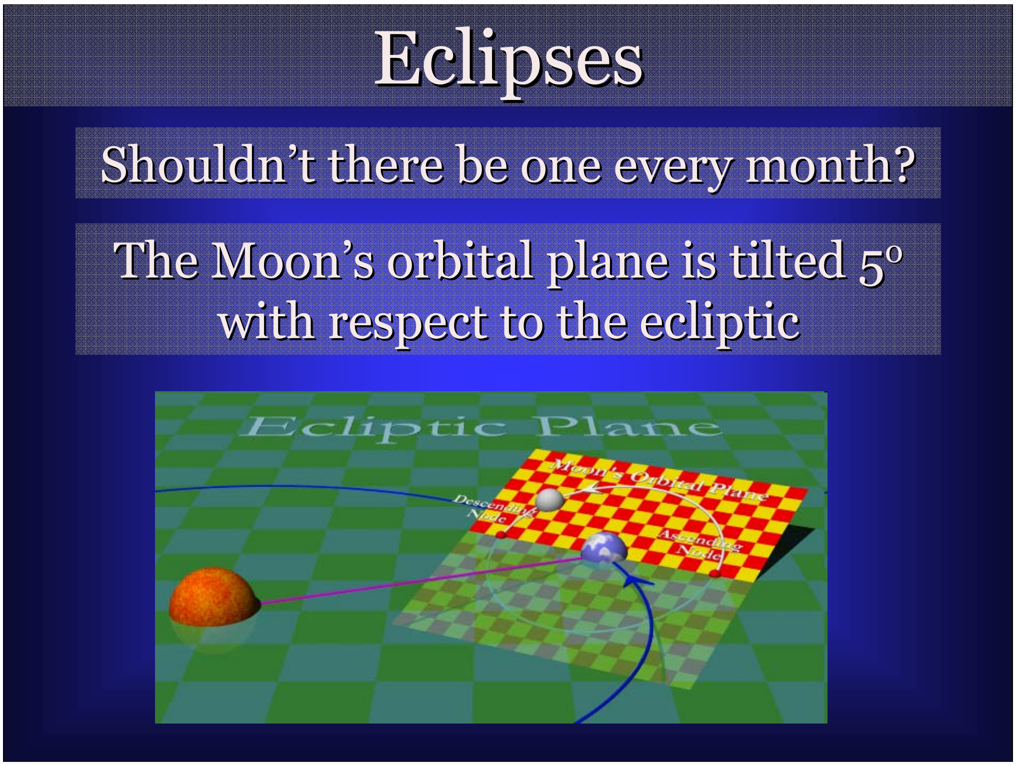
Eclipses

Partial Eclipse
In the **penumbra**

Total Eclipse
In the **umbra**







There is a potential for an eclipse twice a year with a sun/node/earth alignment.

There is no guarantee that the moon will actually pass through the node at the right time.