Astronomy 100
Tuesday, Thursday 2:30 - 3:45 pm

Tom Burbine
tburbine@mtholyoke.edu
Course Material

• **Course Website:**  www.xanga.com/astronomy100

• **Textbook:** Stars, Galaxies, and Cosmology, The Cosmic Perspective, 3rd Edition by Bennett, Donahue, Schneider, and Voit

• **PRS:** You need to have an InterWrite PRS transmitter.
1st HW assignment

• You need to find an article on astronomy (web, newspaper, magazine)
• Print it, copy it, or cut it out
• Read it
• Write one paragraph on why it is important or why you found it interesting
• Staple them together
• Write your name and ID number on front page
• Write the first three letters of your last name in big letters on front page
• Hand it in during next class
• You will then get 1 Homework credit!!
OWL website is now running

- http://owl.oit.umass.edu
- Go to Astronomy
- LOGIN: ID number
- Password: Last Name
- To register PRS: Go to Clicker registration
- If you were not originally registered for the course, you will have to go to follow instructions on the site to be able to log on
PRS

• You need to go OWL to activate PRS
• We will start using Tuesday
• Trying to get roster set before we use it
Tutorial (2nd HW assignment)

- Tutorial to learn how to do HW in OWL
- Needs to be done by 11:59 pm on Feb. 4
- You need to get perfect score to get 1 HW credit!
- No partial credit
3rd HW assignment

• I want you to find information on the constellation that represents your zodiacal sign

• I want you to hand in a picture of the constellation (can be hand drawn) labeled with three star names and a short paragraph on what the constellation is named after

• Write your name and ID number on front page

• Write the first three letters of your last name in big letters on front page

• Hand it in during next class

• You will then get 1 Homework credit!!
What did we learn last time?

• Constellations are patterns of stars
• Sun and Planets are in the ecliptic and travel through the zodiac
• The sky we see is a function of where we are on the Earth
Watch Video
What causes seasons?

• The tilt of the Earth’s axis relative to the ecliptic
Seasons

**Spring Equinox**
The Sun shines equally on both hemispheres. Northern Hemisphere is entering spring; Southern Hemisphere is entering fall.

**Summer Solstice**
Northern Hemisphere receives its most direct sunlight of the year (beginning of summer); Southern Hemisphere receives its least direct sunlight (beginning of winter).

**Fall Equinox**
The Sun shines equally on both hemispheres. Northern Hemisphere is entering fall; Southern Hemisphere is entering spring.

**Winter Solstice**
Northern Hemisphere receives its least direct sunlight of the year (beginning of winter); Southern Hemisphere receives its most direct sunlight (beginning of summer).

*Not to scale! On the scale the orbit is drawn, Earth would be too small to see (and the Sun would be a tiny dot).*
**Summer Solstice:** Midday sunlight strikes Earth more directly in the Northern Hemisphere—meaning the Sun is higher in the sky and casts smaller shadows—than in the Southern Hemisphere.

**Winter Solstice:** The situation is reversed from the summer solstice, with midday sunlight striking the Southern Hemisphere more directly and the Northern Hemisphere less directly.
Solstices

• Summer Solstice – June 21 – Northern Hemisphere receives its most direct sunlight
• Winter Solstice – December 21 – Northern Hemisphere receives its least direct sunlight
Equinoxes

• Sun shines equally on both hemispheres
• Spring Equinox – March 21 – Northern Hemisphere goes from slightly tipped away from the Sun to slightly tipped towards
• Fall Equinox – September 21 - Northern Hemisphere goes from slightly tipped toward from the Sun to slightly tipped away
Images of the Sun snapped at the same time and at the same place throughout the year
Shouldn’t the Summer Solstice be the middle of Summer not the beginning?
Reasons Why Not

• It is much easier to identify the summer solstice by an ancient civilization
• In the Northern Hemisphere, the hottest three months tend to be after the summer solstice
Why does the orbital difference not matter?
Reasons

• There is only a 3% difference in the distance from the Earth to the Sun at its farthest and closest point
• The Earth is actually closer to the Earth in the winter than in the summer
Definitions

- **Perihelion** – a planet is closest to the Sun
- **Aphelion** – a planet is farthest from the Sun
Long Term Changes
Precession

- Earth precesses like a top
- Precession - phenomenon by which the axis of a spinning object (e.g. a part of a gyroscope) "wobbles" when a torque is applied to it
Forces

• For a top, the force is gravity, which is trying to pull the top down
• For the Earth, the forces are due to the pull of the Sun and Earth, which is trying to align the Earth’s axis with the ecliptic
Because of precession

• The position of a star that corresponds to the North Celestial Pole changes
Why do we see the Moon?
Answer

- It reflects light from the Sun
The photos show how the woman would see the lunar phases from Earth as she turns to face the Moon in each position as it orbits Earth.

New Moon
Rise: 6 A.M.
Meridian: noon
Set: 6 P.M.

Waxing Crescent
Rise: 9 A.M.
Meridian: 3 P.M.
Set: 9 P.M.

First Quarter
Rise: noon
Meridian: 6 P.M.
Set: midnight

Third Quarter
Rise: midnight
Meridian: 6 A.M.
Set: noon

Waning Gibbous
Rise: 9 P.M.
Meridian: 3 A.M.
Set: 9 A.M.

Waning Crescent
Rise: 3 A.M.
Meridian: 9 A.M.
Set: 3 P.M.

Full Moon
Rise: 6 P.M.
Meridian: midnight
Set: 6 A.M.

Rise and set times are approximate.
Eclipses

- Lunar Eclipse – Moon passes through Earth’s shadow
- Solar Eclipse – Moon’s shadow falls on Earth
• Umbra – light totally blocked
• Penumbra – light partially blocked
Animation

Ellipses
Lunar Eclipse

Passing through Earth’s shadow

Why is the Moon red?
Shouldn’t it be totally dark?
Why is the Earth Red?

- Even though Earth blocks the moon from direct sunlight during an eclipse, some sunlight is refracted, or bent, by the Earth's atmosphere and illuminates the moon.
- Most of this refracted light is orange or red.
Should you look directly at a Lunar Eclipse?
YES
• Should you look directly at a Solar Eclipse?
No!!!!!!
Planets

• There are 5 planets observable without a telescope
Planets

Planets is from a Greek word meaning “wanderer”
Retrograde Motion
Questions?