

## Lecture 5

### Learning Goals:

By the end of class today you should be able to ...

- Describe the annual motion of the Sun
- Explain why daily and annual motions of objects in the sky occur
- Explain why the Earth experiences seasons
- Explain why the amount of daytime/nighttime changes over a year

Reading for Today: Unit 6

Reading for Next Time: Units 7

- Stars move across the sky each night, but which stars are visible also changes over the course of the year.
  - Daily Motion
  - Annual Motion
- These are each due to different motions of the Earth

### Daily Motion

- The motions of the stars in the sky over the course of a day.
- This is the E → W motion across the sky

### **What causes daily motion?**

### Annual Motion

- Annual motion is how the stars move over the course of a year.
- Why different stars are visible at different times of the year.
  - E.G. Why Orion is up during the winter, and the summer triangle is up during the summer

### **What causes annual motion?**

## Lecture 5

### Ecliptic

- As the Earth revolves around the Sun, the Sun appears to move against the fixed background stars.
- Path the Sun takes across the sky – called the **Ecliptic**
- Plane of the Earth's orbit

### Zodiac

- The constellations the ECLIPTIC passes through – 12 constellations

### **Is the ecliptic different than the celestial equator? Why?**

### Annual Motion of the Sun

- Different constellations are visible at night during different times of the year.
- Because the Earth orbits (or revolves) around the Sun.
- As the Earth revolves around the sun, we see different stars – we view the universe in a different direction
- Sun moves Eastward against background stars one degree/day

### Seasons

#### **•Are seasons caused by the Earth's distance from the Sun changing?**

- We actually experience seasons due to the Earth's axis being tilted 23.5 degrees from vertical.
- As the Earth revolves around the Sun, one hemisphere or the other receives more direct sunlight.
- It's **summer** in the hemisphere receiving more direct, concentrated sunlight
- It's **winter** in the hemisphere receiving less direct sunlight.

## Lecture 5

### Seasons – Height of Sun in Sky

Why is it Cooler in the Winter?

- Sunlight is spread out over a larger area
- → less heat for a given square meter of ground → cooler
- Also, fewer hours of sunlight

### Solstices and Equinoxes

- Equinox – Latin ‘equal night’
- Vernal equinox in the spring near March 21
- Autumnal equinox in the fall near September 23
- Solstice – The sun (sol) stops its northward or southward motion and begins to reverse direction.
- Winter solstice around December 21 – shortest day of year
- Summer solstice around June 21 – longest day of year

• As the Earth orbits the Sun, the Sun’s position with respect to the celestial equator changes.

– Remember the ecliptic and celestial equator are offset from each other because of tilt of Earth’s axis

### Solstices and Equinoxes

• **What are the two days of the year when the ecliptic and celestial equator cross called?**

• **What are the two days of the year when the Sun reaches its furthest point north or south of the celestial equator called?**

Rising Sun Throughout the Year and its path across the sky

Number of Daylight Hours Also Affected by Location on Earth