1.7 Seasons

PRE-LECTURE READING 1.7

- *Astronomy Today,* 8^{th} Edition (Chaisson & McMillan)
- *Astronomy Today,* 7^{th} Edition (Chaisson & McMillan)
- *Astronomy Today,* 6^{th} Edition (Chaisson & McMillan)

VIDEO LECTURE

- Seasons[1] (23:10)

SUPPLEMENTARY NOTES

Cause of Earth's Seasons

- **Not** eccentricity of Earth's orbit (i.e., **not** changing distance to the sun as Earth orbits the sun):
    - Earth's orbit is nearly circular.
- Tilt of Earth's rotation axis (i.e., changing orientation of Earth's northern and southern hemispheres with respect to the sun as Earth orbits the sun). When one hemisphere is oriented toward the sun:
    - The sun illuminates that hemisphere more directly, resulting in more concentrated heating. As viewed from the ground, the sun at, say, midday is higher in the sky.
    - The sun illuminates more of that hemisphere, resulting in longer heating. As viewed from the ground, the sun is up longer and down shorter.
    - The other hemisphere is oriented away from the sun.

Notable Times

Summer Solstice

- 1^{st} day of summer
    - Typically June 21^{st} in the northern hemisphere
    - Typically December 21^{st} in the southern hemisphere
- Longest day of the year
- Sun at midday highest in the sky

[1] http://youtu.be/Kg7N95cOgeA

Autumnal Equinox

- 1st day of fall
  - Typically September 21st in the northern hemisphere
  - Typically March 21st in the southern hemisphere
- Neither hemisphere oriented toward nor away from the sun
  - 12-hour days/12-hour nights

Winter Solstice

- 1st day of winter
  - Typically December 21st in the northern hemisphere
  - Typically June 21st in the southern hemisphere
- Shortest day of the year
- Sun at midday lowest in the sky

Vernal Equinox

- 1st day of spring
  - Typically March 21st in the northern hemisphere
  - Typically September 21st in the southern hemisphere
- Neither hemisphere oriented toward nor away from the sun
  - 12-hour days/12-hour nights

Notable Latitudes

Arctic Circle (+67.6°) and above

- Northern hemisphere summer solstice: 24-hour days
- Northern hemisphere winter solstice: 24-hour nights

Tropic of Cancer (+23.4°)

- Northern hemisphere summer solstice: Sun directly overhead at midday

Equator (0°)

- Always: 12-hour days/12-hour nights

Tropic of Capricorn (–23.4°)

- Southern hemisphere summer solstice: Sun directly overhead at midday

Antarctic circle (–67.6°) and below

- Southern hemisphere summer solstice: 24-hour days
- Southern hemisphere winter solstice: 24-hour nights

EXERCISES

- Experiment with UNL's Seasons Simulator[2].
- Experiment with UNL's Union Seasons Demonstrator[3].
- Experiment with UNL's Paths of the Sun[4].
- Experiment with UNL's Sun Motions Overview[5].
- Experiment with UNL's Sun Motions Demonstrator[6]. (Hide the ecliptic.)
- Experiment with UNL's Sun's Rays Simulator[7].
- Experiment with UNL's Daylight Hours Explorer[8].
- Experiment with UNL's Daylight Simulator[9].
- Using this worksheet, keep track of roughly how high the sun is in the sky around midday as the semester progresses. **Do not look directly at the sun!** Rather, block it with your hand and estimate how many degrees your outstretched arm is above the horizon. 0° is on the horizon. 90° degrees is overhead.

  Also, keep track of roughly how long the day is as the semester progresses. If you are not up for sunrise, keep track of how many hours are between noon and sunset and double it (if daylight saving time, subtract an hour before doubling).

  Since it will probably take a month or two to notice trends, you need only do this every week or two. Do not simply look up the numbers on the internet! The point of this exercise is to see these trends with your own eyes.

[2] http://astro.unl.edu/classaction/animations/coordsmotion/eclipticsimulator.html
[3] http://astro.unl.edu/classaction/animations/coordsmotion/transitmovie.html
[4] http://astro.unl.edu/classaction/animations/coordsmotion/sunpaths.html
[5] http://astro.unl.edu/classaction/animations/coordsmotion/sunmotionsoverview.html
[6] http://astro.unl.edu/classaction/animations/coordsmotion/sunmotions.html
[7] http://astro.unl.edu/classaction/animations/coordsmotion/sunsrays.html
[8] http://astro.unl.edu/classaction/animations/coordsmotion/daylighthoursexplorer.html
[9] http://astro.unl.edu/classaction/animations/coordsmotion/daylightsimulator.html

LAB LINK

Material presented in this unit is related to material presented in Lab 2 of *Astronomy 101 Laboratory: Our Place in Space*[10].

In *Lab 2: Earth and the Seasons,* we:

- Determine how length of day changes with latitude and season.
- Determine how the height of the sun in the sky at midday changes with latitude and season.
- Measure Earth's diameter.

Video Lab Summary

- Earth and the Seasons (Globe Version)[11] (17:46)
- Earth and the Seasons (Stellarium Version)[12] (33:51)

ASSIGNMENT 1

Do Questions 4–6.

[10] http://skynet.unc.edu/introastro/ourplaceinspace/
[11] http://youtu.be/Z3tvQ5ohGTM
[12] http://youtu.be/o1P_JMA0D0w