Patterns in the Sky & Constellations

Textbook, etc.

- Textbook should arrive Monday PM
- Please use Powerpoints on homepage
 - <u>http://faculty.otterbein.edu/UTrittmann/IS2403-01/index.htm</u>
 - http://faculty.otterbein.edu/UTrittmann/IS2403-02/index.htm

WebAssign

- Need to set up a Cengage account first
- Username: first initial plus last name, no space
 - Uwe Trittmann → utrittmann
 - HW #1 due Friday 8pm
- Question: Circumference of circle = pi*r^2

Review Sun's Shadow and Position

- Tangent = ratio of 2 sides of triangle
- Estimate the altitude of the sun: above or below 45 degrees?
- Does this make sense?
- How is the position changing? Hour, day. Month, year later?
- Is the sun ever overhead in Westerville?
- Is the shadow ever infinitely long?

More names, now that we've observed the Sun's position in the Sky

Observer Coordinates

- <u>Horizon</u> the plane you stand on
- <u>Zenith</u> the point right above you
- Meridian the line from North to Zenith to south



Hypothesis

- During a day, it looks like all "lights in the sky" travel around us, like the are fixed to an (invisible) sphere that turns around us.
- Call it The Celestial Sphere

Observation Location Matters

- If we move to a different observing place on Earth, the pattern remains the same (bright light rises & sets, etc.), but:
 - Position of North Star changes
 - Maximal altitude of Sun, special stars changes



Latitude-Longitude coordinates of Earth

Observation Time Matters

- If we observe at a different time, the relative positions of the stars stay the same, but the sky dome apprears rotated:
 - Each hour it rotates 15°, so 360° in 24 hr
 - Later: counterclockwise
 - Earlier: clockwise



Latitude-Longitude coordinates of Earth





The Sky (a) From $40^{\circ}N$ (b)From 50°N (c) From a longitude 90° further west (d)Plus 6 hours later \rightarrow same as (a)!



Conclusion: Earth's coordinates projected onto Sky

The Celestial Sphere

- An imaginary sphere surrounding the earth, on which we picture the stars attached
- Axis through earth's north and south pole goes through celestial north and south pole
- Earth's equator →
 Celestial equator



Celestial Coordinates

Earth: latitude, longitude

Sky:

- declination (dec) [from equator,+/-90°]
- right ascension (RA) [from vernal equinox, 0-24^h; 6^h=90°]

Examples:

- Westerville, OH 40.1°N, 88°W
- Betelgeuse (α Orionis) dec = 7° 24' RA = 5^h 52^m



Confusing! Let's go with Patterns in the Sky!

- We can group specs of light together to form triangles, squares, etc.
- This allows us to find them the next night and follow their motion
- Talk to other observers, and give them names: Bear, Bull, Lion, Hunter, Queen, etc.
- The Constellations

Constellations of Stars

- About 5000 stars visible with naked eye
- About 3500 of them from the northern hemisphere
- Stars that *appear* to be close are grouped together into **constellations** since antiquity
- Officially 88 constellations (with strict boundaries for classification of objects)
- Names range from mythological (Perseus, Cassiopeia) to technical (Air Pump, Compass)

Constellation 1: Orion



Orion as seen at night

Orion as imagined by men

Orion "from the side"



Stars in a constellation are not connected in any real way; they aren't even close together!

Constellation 1: Orion

• "the Hunter"

- Bright Stars:
 D) Betelgeuze
 E) Rigel
- Deep Sky Object:
 i) Orion Nebula



Constellation 2: Gemini

- "the Twins"
- zodiacal sign

Brightest Stars:
 I) Castor
 J=K) Pollux



Constellation 3: Taurus

"the Bull" zodiacal sign

- Brightest Star:
 F) Aldebaran
- Deep Sky Object:
 iii) Plejades



Constellation 4: Ursa Major

- Other name: Big Dipper
 Stars:
 B) Dubhe
 C) Merak
- <u>Navigation:</u> go 5 times the distance from Merak to Dubhe and you are at Polaris.

Ursa Major, the Great Bear (The Big Dipper)



Constellation 5: Ursa Minor

• Other name:

Little Dipper

α Ursa Minoris is
 Polaris [A], the pole star



Constellation 6: Canis Major

• "Big Dog"

Stars:
H) Sirius
(brightest fixed star)







Constellation 8: Leo

- "the Lion"
- zodiacal sign

Brightest Star:
G) Regulus



Constellation 9: Cassiopeia

- Greek mythological figure: mother of Andromeda
- the big "W" in the sky
- No bright stars



Constellation 10: Pisces

- "the Fishes"
- Zodiacal sign

• No bright stars



Constellation 11: Pegasus

- Greek

 mythological
 figure: the
 winged horse
- big rectangle in the sky
- No bright stars



Constellation 12: Andromeda

- Greek mythological figure: Daughter of
 Queen Cassiopeia and King Cepheus rescued
 from Cetus by Perseus
- Deep Sky Object:
 Andromeda
 Galaxy

