Astronomy 100

Section 2– MWF 1200-1300
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Office Hours:
MTF 10:30-11:30 a.m. or by appointment

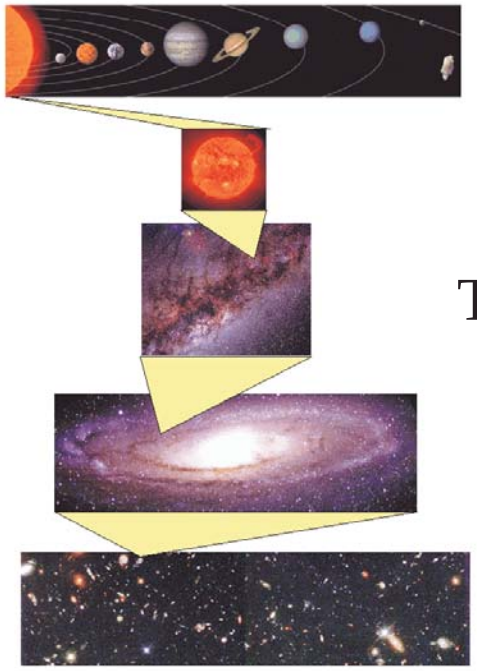
Class Web Page

Remember that you can access the syllabus, observing sheets, and homework through the class website.

1. http://eeyore.astro.uiuc.edu/~lwl/
2. http://www.astro.uiuc.edu/
3. http://eeyore.astro.uiuc.edu/~lwl/classes/astro100/fall03/

Outline

- Stars
  - How many?
- Constellations and asterisms
  - Useful?
- Angular sizes on the sky
  - How long until the Sun sets?
- Diurnal motion
  - Do stars move?
- Celestial sphere
  - To help visualize the movement.



Astronomy: The Big Picture

How many Stars can we see (naked eyed)?

1. A few million million million
2. A few thousand
3. Infinite
4. A few hundred thousand

Stars

In late July 2003, the number of stars was estimated to be:

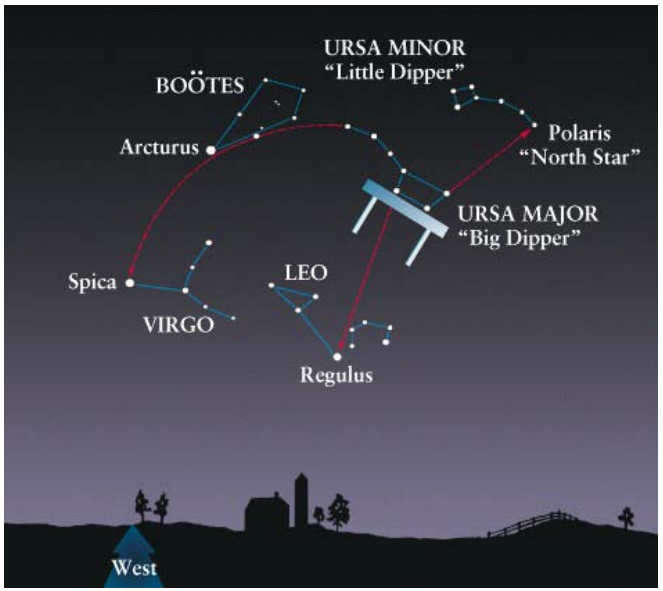
- 70 sextillion
- 70 million million million
- 7 x 10^{22}
- 70,000,000,000,000,000,000,000
- About 10 times the number of grains of sand on all of the Earth's beaches and deserts

The average person on a clear night can see about 3000.

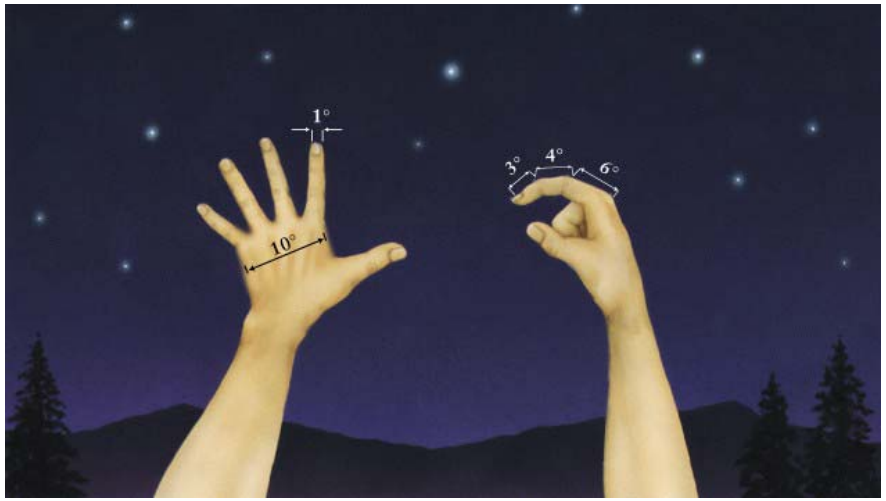
Star Groupings: Constellations

- Constellations are not real– not physical.
- **Constellations** -- only a visual grouping of stars
  - Ancient times - named after gods, heroes, and animals
  - Modern times - 88 constellations with well defined boundaries.
- **Asterism** - a smaller group of stars
  - Usually represent an easily defined pattern in the sky.
    - The Big Dipper
    - The Great Square of Pegasus
- Stars labelled in order of brightness (α, β, γ, δ, etc.)

Constellations

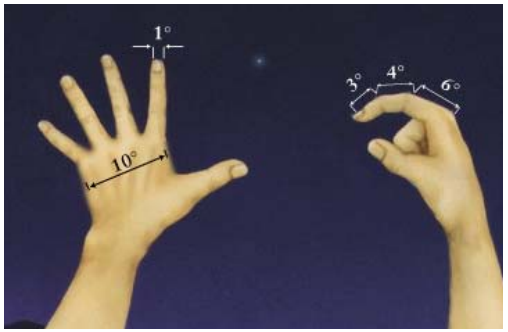


Angular Sizes

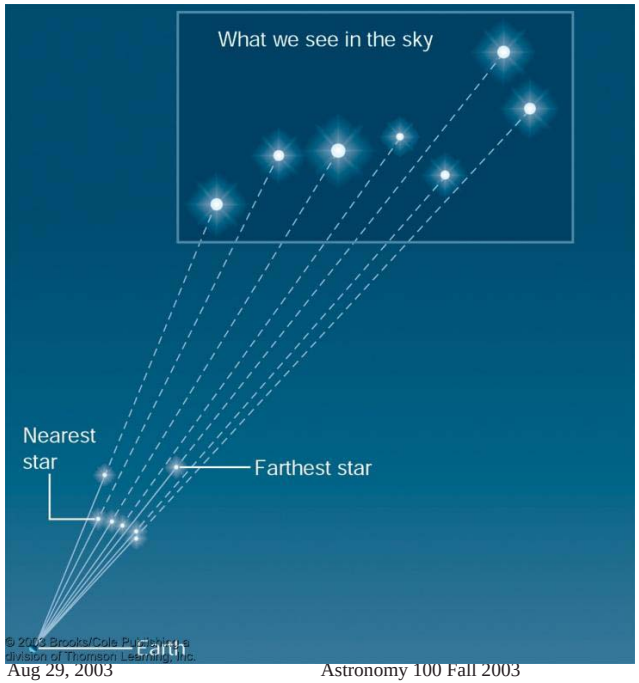


Angular Sizes

- 1 circle = 360 degrees
- 1 degree = 60 minutes
- Diameter of Sun or Moon roughly half a degree
- 1 minute = 60 arcseconds
- Jupiter is about 45 arcseconds
- 1 arcsecond is the angular size of a dime from about 2.5 miles away
- Earth rotates at 360 degrees/24 hours or 15 degrees per hour



Constellations

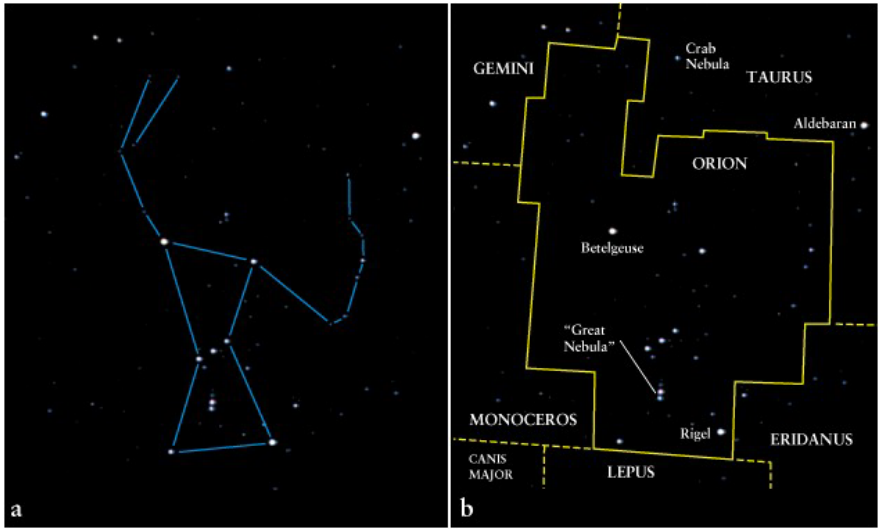


The constellations would look very different if the Earth was somewhere else. In fact many of the stars that we see in a constellation are far away from each other.

Little Dipper

Is Polaris the brightest star in the sky?

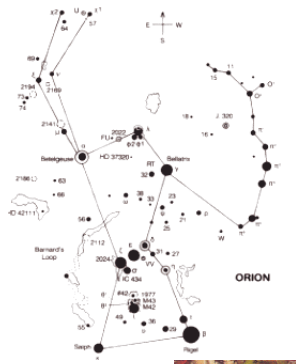
The Constellation Orion

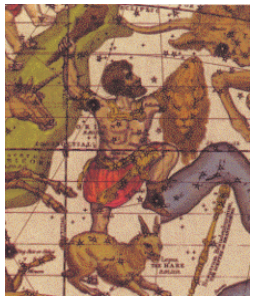


Orion

http://www.astro.wisc.edu/~dolan/constellations/extra/constellations.html

http://faculty.rmwc.edu/tmichalik/orionconst.htm



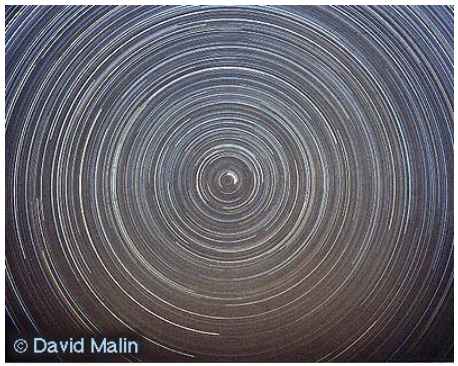


QUESTION:

If we took a time-lapse photo of the starry night sky toward the North Star, what would it look like?

1. As the stars are so far away, they appear fixed, so we'll see a bunch of bright dots.
2. As viewed from the Earth, each star moves differently, so each star will make little circles on the sky.
3. As the Earth rotates the stars seem to rise in the East and set in the West, so we'll see circles centered around the North Star.

Motions in the Sky

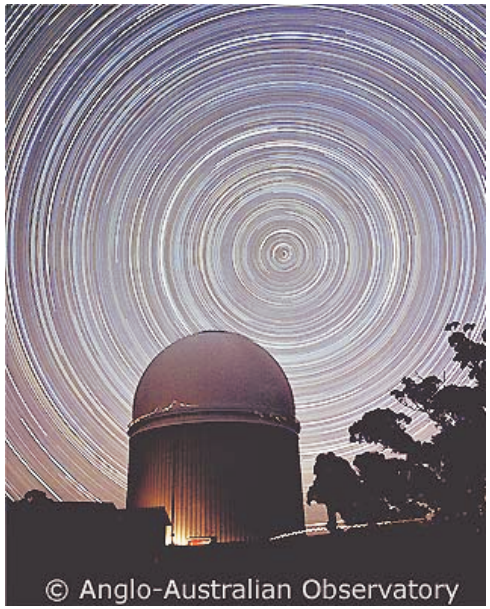


- Earth rotation causes daily motion, also called diurnal motion.
- "Rise in the West and set in the East" is actually the Earth's motion.
- The Sun, Moon, planets, and stars all follow this motion.

Where is Polaris in this picture?

http://www.aao.gov.au/images/captions/aat006.html

Motions in the Sky



Looking toward the South Celestial Pole

Where is Polaris in this picture?

http://www.aao.gov.au/images/captions/aat006.html

Motions in the Sky

Where is Polaris in these two sketches?

Stars that never set at a location are called circumpolar stars. Where will you see the most circumpolar stars?

Motions in the Sky

For locations not at the pole or the equator, the angle is directly related to the latitude.

In fact, the angle of Polaris from the horizon is also directly related to the observing latitude.

For Example, we are at about 40.167 N, 88.167 W, so Polaris is 40.167 degrees above the horizon.

Motions in the Sky

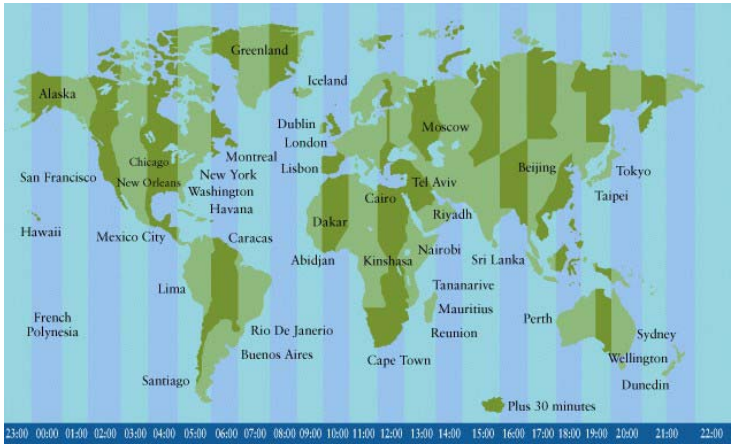
Photograph from Mt. Kilimanjaro in Tanzania, Africa, which is at 3 Degrees South Latitude.

Where is Polaris here?

http://www.danheller.com/images/Africa/Tanzania/Kilimanjaro/Mountain/Slideshow/img15.html

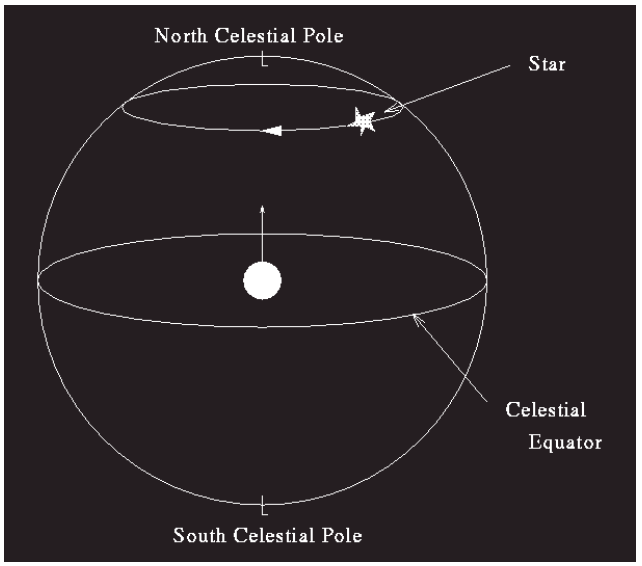
How does it effect your TV shows?

The Earth rotates 15 degrees every hour so "Noon" occurs at different times at different places.



The Celestial Sphere

How can we set the data we have into a simple picture?



http://zebu.uoregon.edu/~imamura/121/images/diurnal.gif

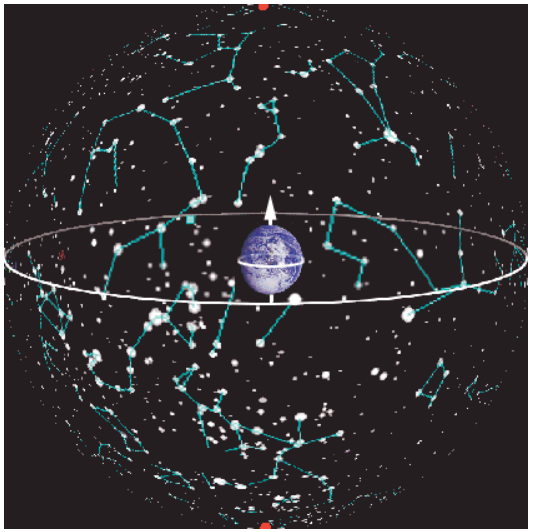
The Celestial Sphere

Put all of the stars on a transparent globe.

•The Earth's North Pole is under the North Celestial Pole.

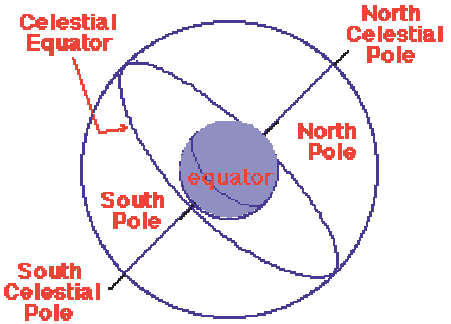
•The Earth's South Pole is under the South Celestial Pole.

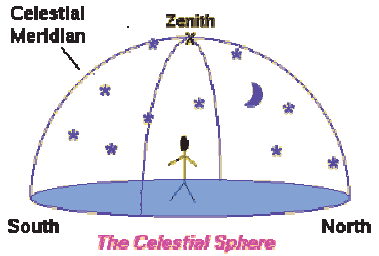
•The Earth's equator is under the Celestial equator.



http://www.astro.uiuc.edu/classes/archive/astr210/s02/Images/spheroid1.gif

Other ways to look at the same thing.

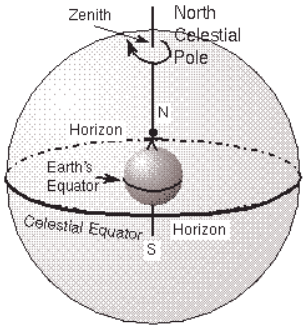




• Zenith– the point directly above the observer

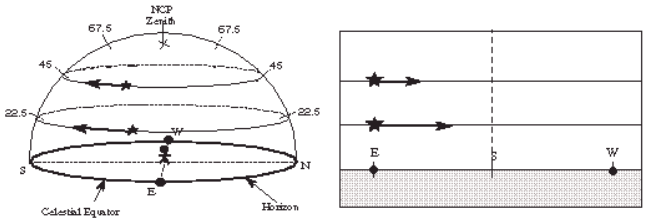
• Horizon– the imaginary line that marks the intersection of Earth and Sky.

http://csep10.phys.utk.edu/astr161/lect/celestial/celestial.html

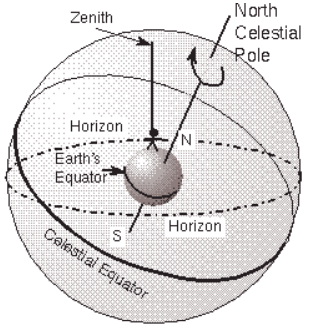


Latitude = 90° N (at North Pole)

altitude of NCP = 90°

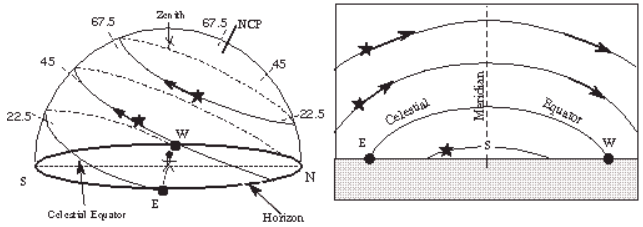


Meridian altitude of Celestial Equator = 0°

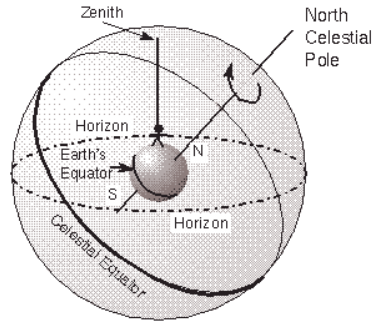


Latitude = 65° N

altitude of NCP = 65°

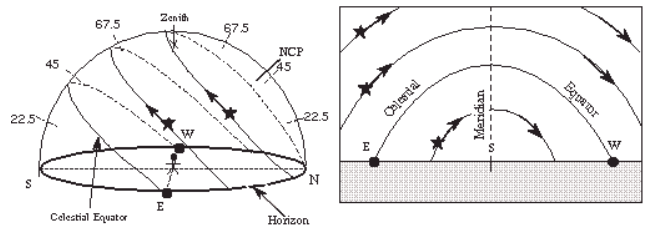


Meridian altitude of Celestial Equator = 25°

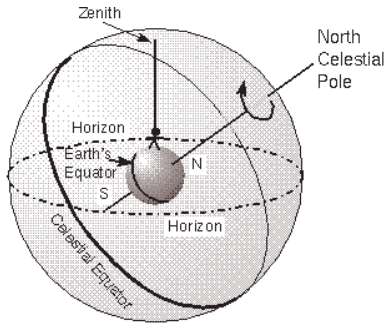


Latitude = 47° N

altitude of NCP = 47°

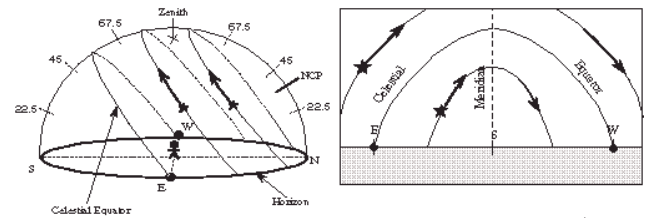


Meridian altitude of Celestial Equator = 43°

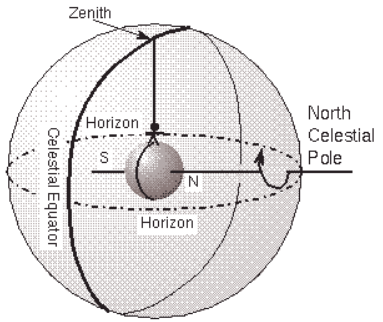


Latitude = 34° N

altitude of NCP = 34°

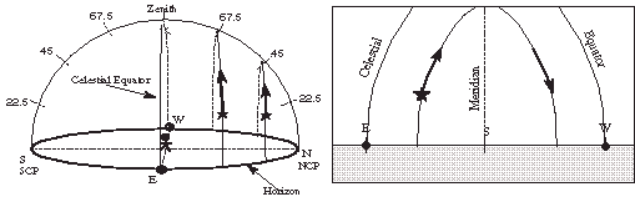


Meridian altitude of Celestial Equator = 56°



Latitude = 0° N

altitude of NCP = 0°



Meridian altitude of Celestial Equator = 90°

Reality

- Really the stars are not fixed to a transparent sphere.
- It is a good approximation for “naked-eye” astronomy because the stars are REALLY far away– more than 25 trillion miles.
- BUT, the stars do move with respect to each other.
- Nonetheless, the celestial sphere is useful for finding your way around the skies.
- Next week, we’ll see that there are also yearly motions.

Question?

What would the constellations look like from the point of view of a nearby star?