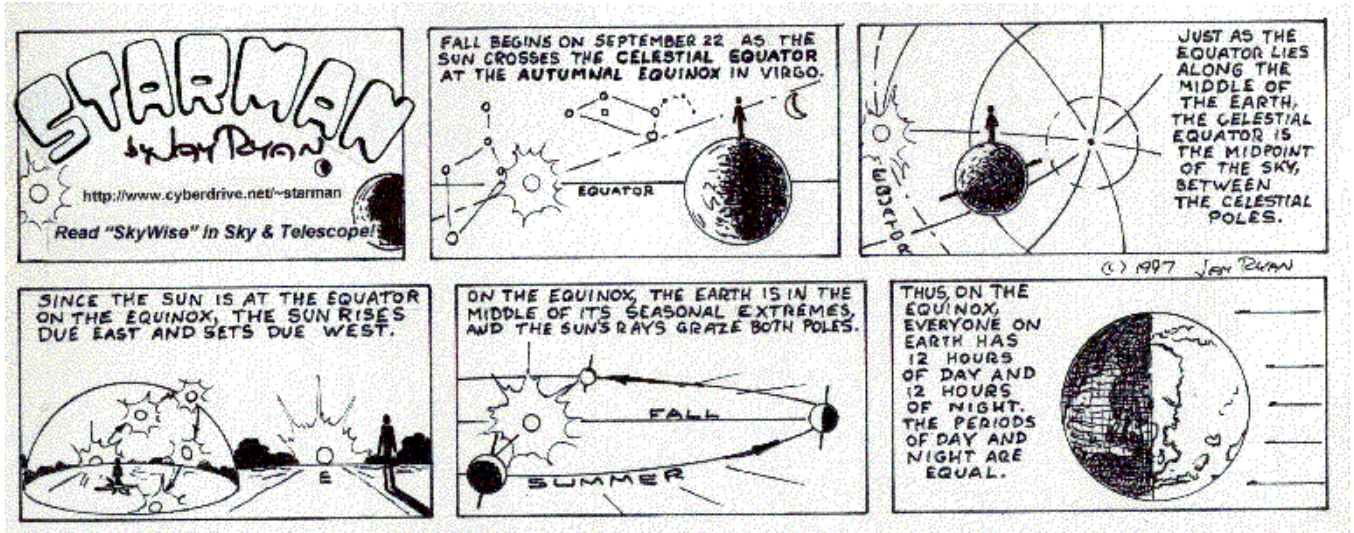


REVIEW: OBSERVING THE SKY

MAJOR TOPICS : APPEARANCE AND MOTIONS IN THE SKY

- Constellations
- Coordinate Systems (horizon, RA & Dec, etc.)
- Daily motion
- Annual motion of the Sun & Stars (the Ecliptic & Analemma)
- Motion and phases of the moon
- Motion and positions of the Planets

BRING YOUR FIELD GUIDE TO THE EXAM!!!



I. THE CELESTIAL SPHERE

A. Constellations: **FIELD GUIDE (FG) Ch. 4**

- Origin and organization, asterisms
- Constellation names, abbreviations, genitives (**FG pp. 512-513**), boundaries (on Atlas Charts)
- Star names ("other" and Bayer designation)
 - Know how to find them! (Atlas Charts and Star Distances & Magnitudes Labs)

Sky Stuff to Know:

Constellations: UMa, UMi, Dra, Boö, CrB, Her, Lyr (+ Summer Triangle stick figures)

Motions: Earth, Sun, Moon

Solstices & Equinoxes

Know their definitions!

Know their α , δ , PL, date, & constellation

Know how to find the Atlas Chart of Each

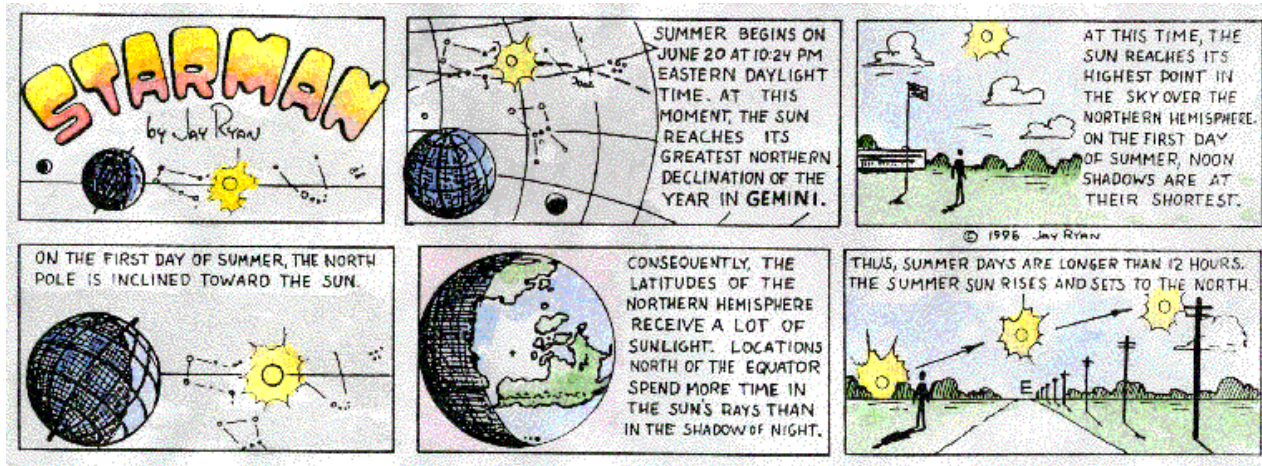
B. Coordinate systems: **FIELD GUIDE Ch. 15**, [Fraknoi et al. Ch. 4.0 - 4.1](#), Raymo Oct. 7 - 24

- horizon - horizon, zenith, nadir, meridian, etc.
- celestial - RA, Dec, NCP, SCP, Celestial Equator, PL (Celestial Coordinates & Changes in Latitude Labs)

Review the Powerpoints

Review All the Labs (ALL the calculations)



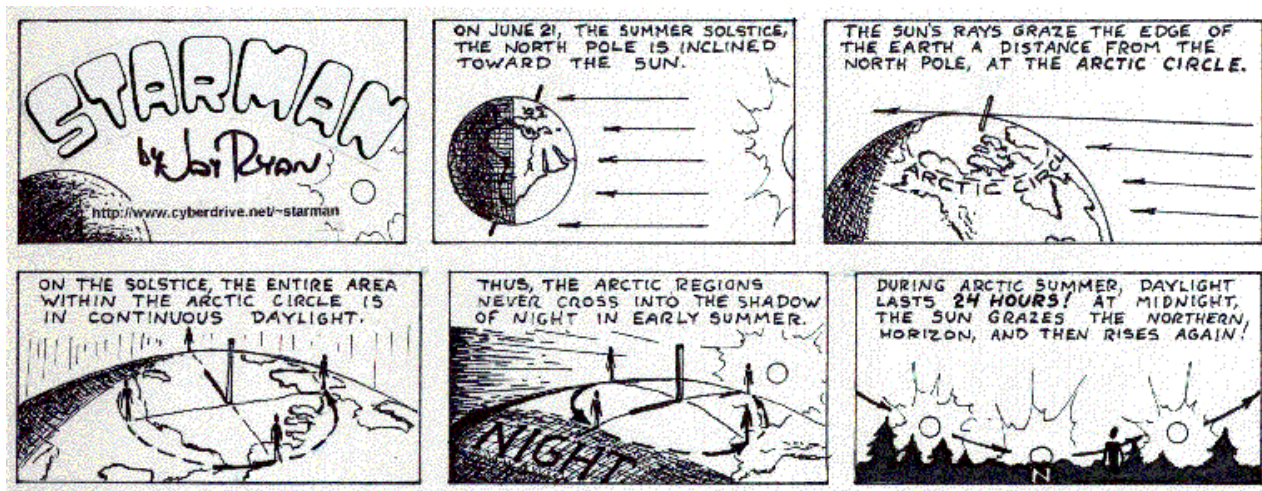


C. Motions in the sky

- daily motion **CYCLES** pp. 1-10, [Fraknoi et al. Ch. 4.2](#)
stars, sun, moon, planets, comets, etc. circle NCP once per day (Rising, Setting & Time in the Sky and Speed of Noon Labs) (Time Zones & Celestial Navigation Labs)
- annual motion **CYCLES** pp. 20-32
Equinoxes and Solstices: RA, Dec, PL, sub-solar latitude, constellation, date (Ecliptic Lab TABLE!)
Sun's motion along the ecliptic in PL, and in RA and Dec, the Zodiac
Sidereal and Solar day and the Analemma (Transit Times, Day Through the Seasons, & Events labs)
named latitudes ... numerical latitudes, explanations from Earth's tilt (Named Latitudes Lab)
- planetary longitude, elongation & configurations (conjunctions, opposition, greatest elongation) (Events and Positions of the Planets Labs, Appendix 11)
- precession (Astronomy & Astrology Lab)
- motion and phases of the moon **CYCLES** pp. 11-19, [Fraknoi et al. Ch. 4.5 - 4.7](#)
phases, elongations, times of rising, transit, and setting (Moon Phases Lab!!)
eclipses ... definitions & why they don't happen every month
tides ... causes and consequences

Be able to fill in the table on "The Ecliptic" Lab from memory!

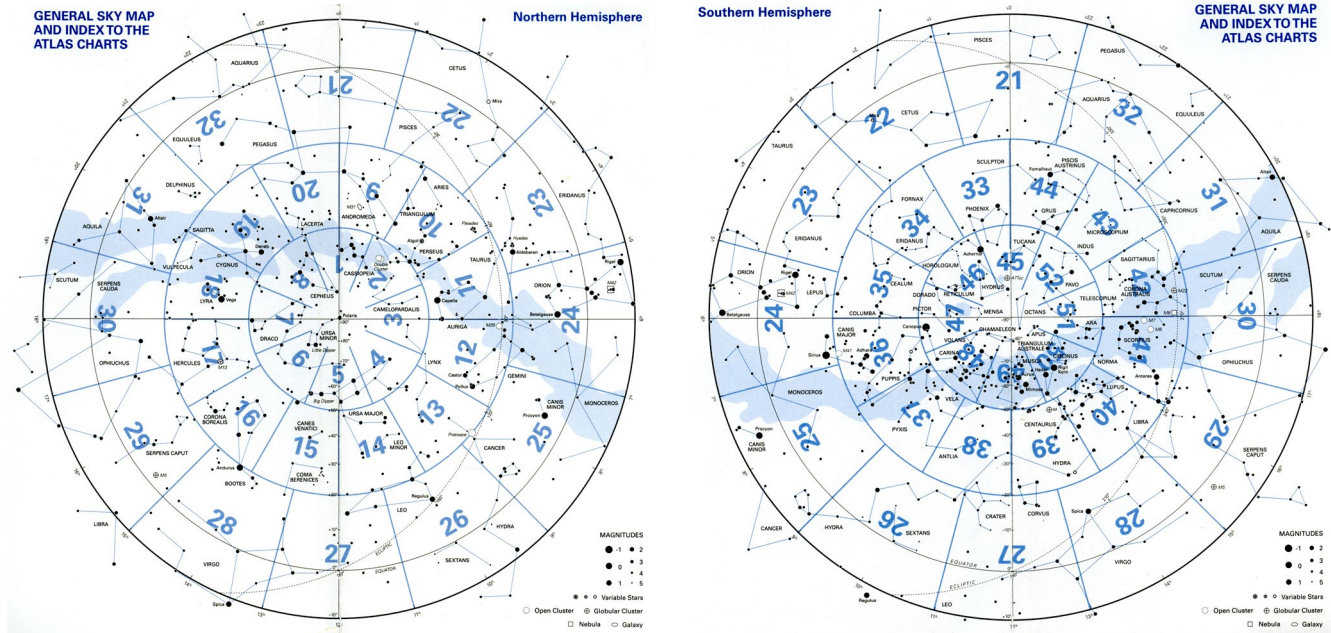
COME PREPARED TO THINK HARD FOR TWO HOURS!
KNOW HOW TO DO WHAT YOU DID ON THE LABS



Lab Summary Fall 2024

1. Atlas Charts

Found the Atlas Charts for the Big & Little Dippers using the guide map and read them to learn about the stars in those asterisms and other objects in those areas of the sky.



2. Star Distances and Magnitudes

Used Appendix 2 to look up information about stars in the Summer Triangle and ranked them in order of distance, apparent magnitude (V) and absolute magnitude (M_v). Brighter objects have lower magnitudes ... Vega $V_{\text{Vega}} = 0.03$ is brighter in the sky than Deneb $V_{\text{Deneb}} = 1.25$, but Deneb is intrinsically brighter than Vega: $M_{v,\text{Deneb}} = -7.5$ $M_{v,\text{Vega}} = 0.6$.

3. Celestial Coordinates

Identified stars on celestial globes using their coordinates and identified coordinates on the atlas chart sky maps.

Right Ascension (Celestial Longitude), 0^{h} to $23^{\text{h}}59^{\text{m}}59^{\text{s}}$ eastward from Υ

Declination (Celestial Latitude), 0° to $\pm 90^{\circ}$ northward & southward from Celestial Equator

4. Changes in Latitude

Wrote down the altitudes of the celestial pole and celestial equator for various latitudes then identified them on horizon diagrams. λ = latitude of the observer.

ALTITUDE OF CELESTIAL POLE = LATITUDE OF THE OBSERVER!

5. Star Trails

Using photographs of the trails of rising stars, we determined the (approximate) latitudes from which each photograph was taken.

Stars rise and set parallel to the C. E. at an angle of $90^{\circ} - \lambda_{\text{observer}}$ to the horizon

6. Star Transit Times

We looked up the transit times for a variety of stars using p. 13 in the *Field Guide* in both standard (EST) and daylight saving time (EDT). Vega's transit times through the summer showed that stars transit 4 minutes earlier every night.

7. Rising, Setting and Time in the Sky

Looked up star names in Appendix 2 using their right ascension. From their declinations, calculated their rising and setting azimuths, maximum altitudes and times above the horizon.

For λ = latitude of the observer and δ = declination of the star, we determined the azimuths of rising and setting, the altitude of the star at transit (the maximum), and the hours the star will be above the horizon using the following equations:

$$A_{\text{rise}} = \cos^{-1} \left(\frac{\sin \delta}{\cos \lambda} \right) \text{ degrees} \quad A_{\text{set}} = 360 - A_{\text{rise}} \text{ degrees}$$

$$A_{\text{max}} = (90 - \lambda) + \delta \text{ degrees} \quad \Delta t = \frac{2}{15} \cos^{-1} (-\tan \lambda \tan \delta) \text{ hours}$$

8. Time Zones

Wrote down the longitudes of the time zone centers in the western hemisphere, converted UT to EDT and EST. For cities at different longitudes, calculated the time of solar noon given the longitude of each city's time zone center.

Earth turns $15^\circ/\text{hour}$, 1° in 4 minutes, and 15 arcminutes in one minute

\Rightarrow an observer east of the TZ center sees events (degrees) $\times \left(\frac{4 \text{ minutes}}{1 \text{ degree}} \right)$ early.

\Rightarrow an observer west of the TZ center sees events (degrees) $\times \left(\frac{4 \text{ minutes}}{1 \text{ degree}} \right)$ late.

9. Celestial Navigation

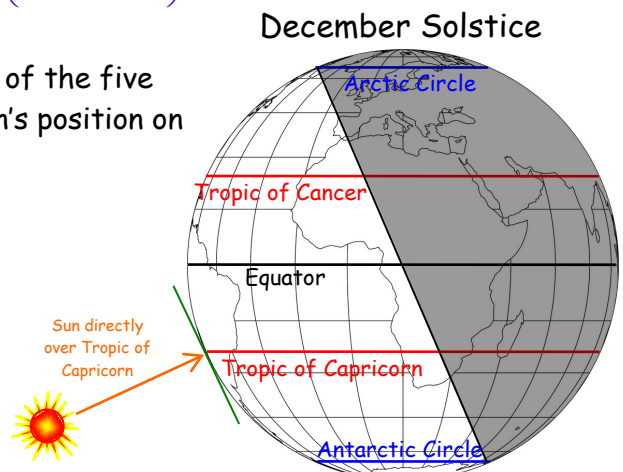
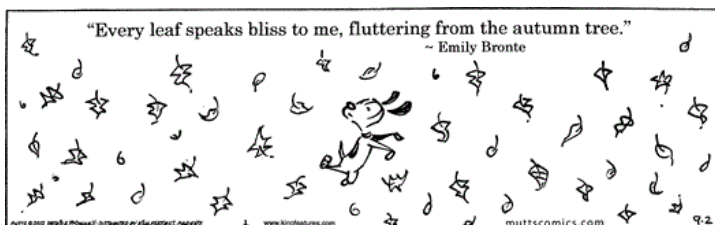
We determined an observer's latitude from the altitude of Polaris and longitude from the difference between the observed and expected transit times of Procyon on a particular day.

\Rightarrow an observer who sees events early is (minutes) $\times \left(\frac{1 \text{ degree}}{4 \text{ minutes}} \right)$ east of TZ center.

\Rightarrow an observer who sees events late is (minutes) $\times \left(\frac{1 \text{ degree}}{4 \text{ minutes}} \right)$ west of TZ center.

10. Named Latitudes

We determined wrote the geographic significance of the five named latitudes and shaded the Earth to show the sun's position on the solstices and equinoxes.



11. The Ecliptic

We looked up the celestial position of the Sun on Sept. 10 in Leo. Used the Atlas Charts to determine information about the Solstices and Equinoxes.

The Ecliptic is the apparent path of the sun across the sky through the year. It is also the Earth's orbital plane.

THE TABLE YOU FILLED OUT WILL BE ON THE EXAM VERBATIM! KNOW IT!

12. The Day Through the Seasons

Using the Analemma to find solar declinations, we found the azimuths of rising and setting, the maximum altitudes and hours above the horizon for various cities. We also used the Analemma to determine the clock times of solar noon for various dates.

For observer at different latitudes (λ) and different declination of the sun (δ), we determined the azimuths of rising and setting, the altitude of the star at transit (the maximum), and the hours of daylight using the same equations as in lab exercise 7.

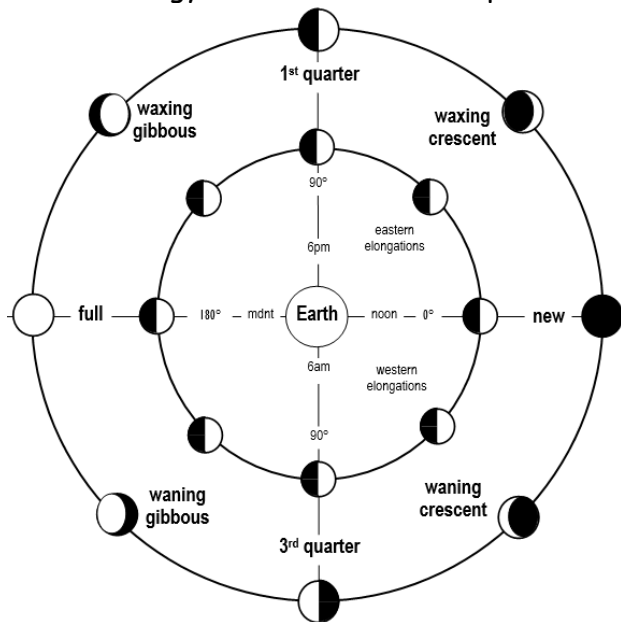
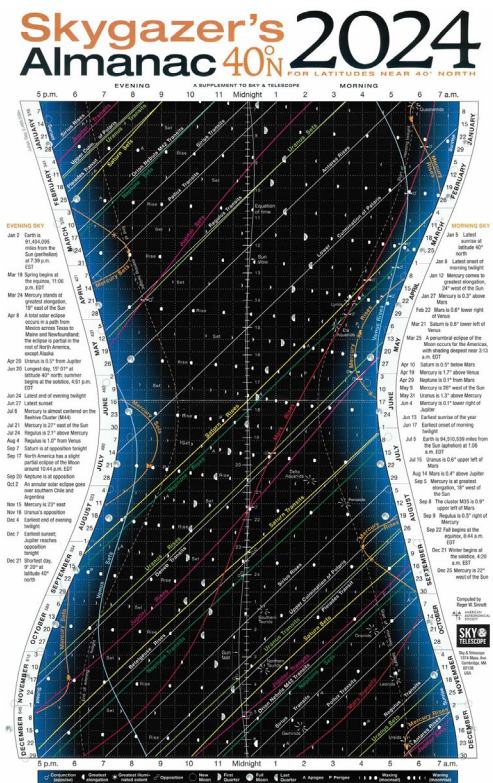
13. Planets in the Sky

Used Appendix 11 to look up planetary longitudes of the sun and (5 naked-eye) planets on a given date. From these we determined the Atlas Charts for the positions of the sun and planets to find what constellation each was in. We then calculated the elongations and plotted their positions for an observer at sunrise and in the solar system.

Planetary Longitude measured east from Υ to 360° along ecliptic.
Elongation = angle from sun to object.

14. Astronomy and Astrology

Used Starry Night to look at the sky at the moments of our births from the places of our births. Compared the astronomical constellations the sun, moon and planets were in to the astrological "houses" they were in according to our natal charts. Most of the constellations were different showing that astrology is not a scientific representation of the sky.



15. Graphic Timetable: Events of a Single Night

After answering questions about the the Sky & Telescope Skygazer's Almanac, we used it to find all the events that will occur during the night of Sep. 17-18, 2023.

16. Moon Phases

Filled out a table of phases, elongations, rising time, transit time, and setting time for the eight phases from one piece of given information on each.