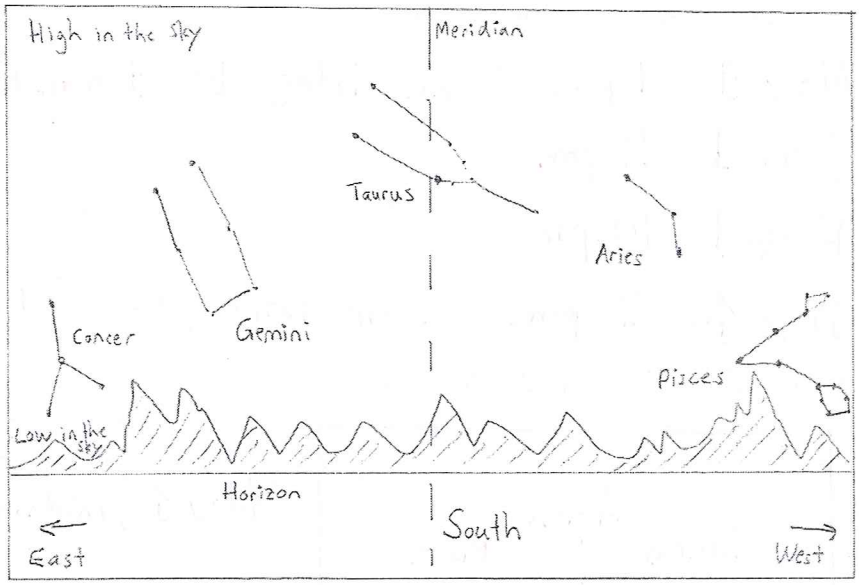
INST 2403

Seasonal Motion

Stars, sun, moon and planets move with respect to the observer from east to west and reach their maximal altitude in the sky on the meridian (in the south for observers in the northern hemisphere). This is called diurnal or **daily motion**. Close inspection shows that the sun moves slightly slower than the stars: a **solar day** of 24 hours is four minutes longer than the star or **sidereal day** of 23 h 56m. Therefore the stars rise four minutes earlier each day. This slight shift of the view of the sky that sums to two hours in a month is known as **seasonal motion**.

Consider the figure below. This horizon view show what you would see when facing south at mid-northern latitudes at midnight on December 1. High in the south is Taurus, medium high in the south-east resides Gemini, low in the east is Cancer, medium high in the south-west is Aries, and low in the west you see Pisces.



1. Where is the Sun? Describe its position using words like east, south, west, north, **and** high in the sky, below the horizon, etc., reflecting the fact that the sky is **two-dimensional**.

   North, below the horizon (It is midnight!)

2. There are twelve constellations of the zodiac along the 360 degree path of the sun among the stars, a circle we call the **ecliptic.** On average, how wide (in degrees, i.e. angular size) is each of these constellations?

   $360°/12 = 30°$

3. The celestial sphere turns once a day. How many degrees does it turn in one hour?

   $\frac{360°}{24h} = 15°/hr$

4. How long does it take until the next constellation in the figure will be at the position now taken by Taurus?

Width of one constell.: 30°, so 2×15° = 30° in 2 hours

5. Which constellation will that be?

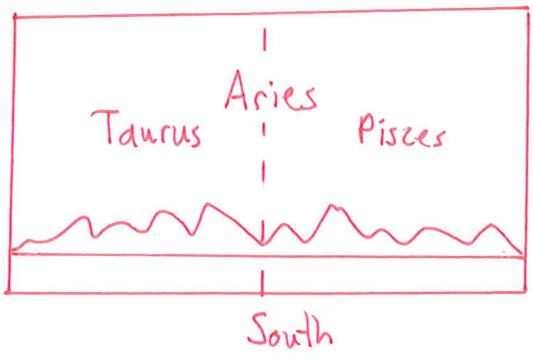
Gemini, constell. drift westward

6. The sun goes around the ecliptic in one year, i.e. 365 days. How much does in move each day …
   a. …with respect to the ground or observer? 360°/d
   b. …with respect to the celestial sphere or stars? ≈ 1°/d ($\frac{360°}{365\ d}$)

7. Make a list of four dates and times (for example, December 1 at 12:00am) when the sky will look exactly like in the figure above.

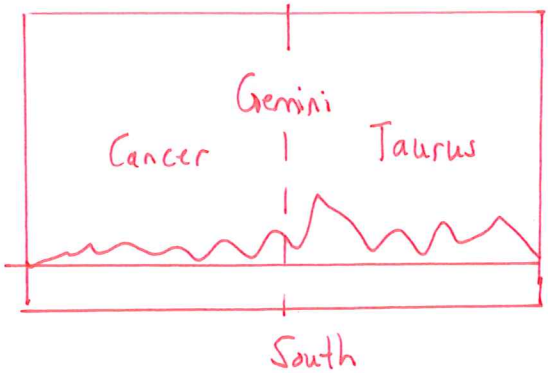
Nov 1 2 am (2 hrs later, b/c 1 month earlier)
Jan 1 10 pm
Feb 1 8 pm
Dec 16 11 pm (1 hr later, b/c ½ month earlier)

8. Draw the horizon view at midnight a month earlier.



Nov 1, midnight

9. Draw the horizon view at midnight a month later.



Jan 1, midnight