Motion Lecture Tutorial: Pages 3-6

- Work in groups of 2-3
- Read the instructions and questions carefully.
- Discuss the concepts and your answers with one another. Take time to understand it now!!
- Come to a consensus answer you both agree on and write complete thoughts in your workbook.
- If you get stuck or are not sure of your answer, ask another group.
- If you get really stuck or don’t understand what the Lecture Tutorial is asking, ask me for help.

Using Angles

Distances on the sky are measured in degrees, arc-minutes, and arc-seconds

- 1 degree = 60 arc-min
- 1 arc-min = 60 arc-sec
- Width of index finger = 1°
- Width of three fingers = 5°
- Width of entire hand = 10°

Looking at the Night Sky

How to find your way around:
- Position -> where is that object?
- Distance -> how much space between these two things?
- Motion -> where will that object be later tonight?
- Bright/faint objects -> magnitude!

Measuring Stars: Magnitudes

Constellations help us find our way in the sky, but we want to know more…

- Ancient people classified stars into 5 classes:
  - “First Magnitude” stars were the brightest
  - “Fifth Magnitude” stars were the faintest
- A modified version of this system is still used

Magnitudes

- A star’s intensity (or brightness) is the amount of light we receive from it.
- Intensity is measured on the Magnitude Scale
  - Lower magnitudes = brighter stars
  - Higher magnitudes = fainter stars
- The scale is logarithmic (like the Richter Scale)
- Difference of 1 magnitude = 2.5 times brighter
- Difference of 5 magnitudes = 2.5 x 2.5 x 2.5 x 2.5 x 2.5 times brighter = about 100 times brighter

Examples of Magnitudes
The Magnitude Scale

• Originally there were only magnitudes 1-5

• However a very bright object can even have a negative magnitude.
  – Venus’s magnitude is -4
  – The full Moon is magnitude -12.7

• A very faint (low intensity) object can have a magnitude above 5.
  – Human eyes can only see down to magnitude 5
  – A distant galaxy has a magnitude of 20

What can you see?

What we can see in the sky (constellations) at any given time is determined by three factors:
  – Time of night/day
  – Latitude (but not longitude!)
  – Time of year

Review: Coordinates on the Earth

• Latitude: position north or south of equator
• Longitude: position east or west of prime meridian (runs through Greenwich, England)

The sky varies with latitude but not longitude.

Altitude of the celestial pole = your latitude
Why do the constellations we see depend on latitude and time of year?

- They depend on latitude because your position on Earth determines which constellations remain below the horizon.
- They depend on time of year because Earth’s orbit changes the apparent location of the Sun among the stars.

Why can’t we see the same constellations all year round?

The Sun is in front of different constellations!

The sky varies as Earth orbits the Sun

- As the Earth orbits the Sun, the Sun appears to move eastward along the ecliptic.
- At midnight, the stars high in the sky are opposite the Sun in the sky.

Constellations along the Sun’s path

- The path of the Sun (ecliptic) was an important part of ancient astronomy
- The planets and Sun represented deities, and their positions were significant
- Most ancient astronomers were also in the astrology business

Zodiac -
The 13 Zodiacal constellations that our Sun covers-up (blocks) in the course of one year (used to be only 12)

<table>
<thead>
<tr>
<th>Constellation</th>
<th>Dates of Sun’s Passage Through</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pisces</td>
<td>March 13–April 20</td>
</tr>
<tr>
<td>Aries</td>
<td>April 20–May 13</td>
</tr>
<tr>
<td>Taurus</td>
<td>May 13–June 21</td>
</tr>
<tr>
<td>Gemini</td>
<td>June 21–July 20</td>
</tr>
<tr>
<td>Cancer</td>
<td>July 22–August 11</td>
</tr>
<tr>
<td>Leo</td>
<td>August 13–September 18</td>
</tr>
<tr>
<td>Virgo</td>
<td>September 18–November 1</td>
</tr>
<tr>
<td>Libra</td>
<td>November 1–November 22</td>
</tr>
<tr>
<td>Scorpius</td>
<td>November 22–December 1</td>
</tr>
<tr>
<td>Ophiuchus</td>
<td>December 1–December 19</td>
</tr>
<tr>
<td>Sagittarius</td>
<td>December 19–January 19</td>
</tr>
<tr>
<td>Capricorn</td>
<td>January 19–February 18</td>
</tr>
<tr>
<td>Aquarius</td>
<td>February 18–March 13</td>
</tr>
</tbody>
</table>
The Zodiacal Constellations that our Sun covers-up (blocks) in the course of one year (only 12 are shown here)

Figure 1

What time is it for the observer?

What is the name of the constellation that would appear on the observer's Eastern Horizon? Western?

Which constellation is the Sun in front of for the situation shown?

12 hours later what object will be at the position that Taurus is in now?

18 hours later where will the Sun be? Where will Scorpius be?

Lecture-Tutorial: Seasonal Stars (p. 7-9)

- Work with a partner!
- Read the instructions and questions carefully.
- Discuss the concepts and your answers with one another.
- Come to a consensus answer you all agree on.
- If you get stuck or are not sure of your answer, ask another group.
- If you get really stuck or don’t understand what the Lecture Tutorial is asking, ask me for help.