The Night Sky

Lecture 25

Outline

- The night sky - overview
- Why the sky changes
  - During the night
  - From night to night
- Some definitions
  - Celestial sphere, ecliptic, zodiac, zenith, meridian
Things to see in the night sky

- The Moon & Planets
- Stars
  - Constellations
  - Asterisms (groupings of stars)
    - e.g. the Pleiades
  - Binaries
  - Variable Stars
Tonight at 8:00 pm
In-Class Question

- Roughly how many stars are visible to the unaided (eye over the entire sky), that is, how many could you see

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>6</td>
</tr>
<tr>
<td>B.</td>
<td>600</td>
</tr>
<tr>
<td>C.</td>
<td>6,000</td>
</tr>
<tr>
<td>D.</td>
<td>60,000</td>
</tr>
<tr>
<td>E.</td>
<td>600,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visual Magnitude</th>
<th>Total # of stars</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>900</td>
</tr>
<tr>
<td>5.5</td>
<td>2,800</td>
</tr>
<tr>
<td>6.5</td>
<td>8,800</td>
</tr>
<tr>
<td>7.5</td>
<td>27,000</td>
</tr>
</tbody>
</table>

With binoculars or a telescope

<table>
<thead>
<tr>
<th>Object</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globular cluster</td>
<td>M13 in Hercules</td>
</tr>
<tr>
<td>Open clusters</td>
<td>Pleiades, h and χ Perseus</td>
</tr>
<tr>
<td>Planetary Nebula</td>
<td>Ring Nebula</td>
</tr>
<tr>
<td>Galaxy</td>
<td>Andromeda</td>
</tr>
</tbody>
</table>
M13 – Globular Cluster

$\text{h}$ and $\chi$ Perseus
Pleiades Star Cluster

Ring Nebula (M57)

Ground Images

HST Image

Deeper exposure

Above - rescaled
But where to look?

- Need to know where an object is on the sky (coordinates or its location relative to some reference stars or constellations)

- And what time that part of the sky is viewable, e.g. the sun is not up.
  - Time of night and
  - Time of year
How do we know where and when to look?

The major motions that affect the night sky are:

- Rotation of the earth
  - Causes the stars to move through the sky at night.
- Revolution of the earth around the sun
  - Causes different stars to be available at different times of the year.
Real proportions

- If the sun were the volleyball:
  - ~ 8 in = 20 cm in diameter
- The earth is smaller than a pea:
  - ~ 1.8 mm in diameter
- The earth-sun distance is:
  - 22 m (about 70 feet)

Cycles of the Sky

- A class demo, wherein
  - the part of the sun is play by a tennis ball
  - while the earth is played by a volleyball,
  - and the students are, of course, stars.

  (And I get to play Atlas!)
In-Class Question

What causes the stars to move through the sky at night?

A. The rotation of the sky about the Earth
B. The rotation of the Earth
C. The revolution of the Earth about the Sun
D. Magic
E. The planets drag the stars along with them
The Celestial Sphere

- The celestial sphere is the vast hollow sphere on which the stars appear fixed.
- The celestial equator is defined by extending the earth's equator outward.
- The N & S poles of the celestial sphere correspond to the earth's poles.

The Ecliptic

- The ecliptic is the apparent path of the sun through the sky.
- It is also the plane of the earth's orbit about the sun on the celestial sphere.
- Note: The ecliptic is tilted w.r.t. the earth's equatorial plane by 23.5°.
The Zodiac

- The **zodiac** is a band of celestial sphere which represents the path of the planets, the moon and the sun.
- Extends ~8° to either side of the ecliptic.
- In astrology the zodiac is divided into 12 equal parts called signs, each bearing the name of a constellation.

Astrology is NOT a science!

- Propagates the claim that a person’s life is determined by the position of the sun, moon, and planets at birth.
- This notion is patently false, and potentially harmful.
- Astrology is neither a science nor a religion.
**Zenith**

The zenith is the point on the celestial sphere that is directly above the observer.

**Meridian**

The meridian is the great circle passing through the two poles of the celestial sphere and the observer's zenith.