Observing the Moon
Moon (Luna):
- changes position in sky
  - goes around Cel. Sphere in ~1 month
- changes appearance: “Phase”
  - depends on locations of Earth, Moon and Sun

Moon revolves around the Earth:
  Same direction as Earth rotates
  - Follows “Right-Hand Rule”

We can only see portion of the Moon that is illuminated by sunlight
New Moon: (beginning of lunar month)
- moon is between earth & sun
- sunlit side faces away from earth

What we see: - Moon is not visible
(0% illuminated as seen from Earth)

Sun-lit portion of moon gets larger (as seen from earth) - "Waxing"

What we see: Waxing Crescent

Crescent = less than half full
(<50% illuminated)
What we see: First Quarter

(50% Illuminated)

What we see: Waxing Gibbous

Gibbous = more than half full
(> 50% illuminated)
Full Moon:
- on opposite side (180°) from sun
- entire sunlit side facing earth

What we see:

Sun-lit portion decreases - waning

What we see:
<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
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http://stardate.org/nightsky/moon/
http://www.astro.wisc.edu/~dolan/java/MoonPhase.html
Motion of Moon Across Sky

- moves 13 degrees eastward each day
  → moon will rise 52 minutes later each day

Synodic (Lunar) Month
- time between two successive new moons: ~ 29.5 days

Sidereal Month
- time moon takes for one complete orbit of earth: ~ 27.3 days
Eclipses

Solar Eclipse:
- moon blocks out the sun, sun disappears

Lunar Eclipse:
- moon passes through earth’s shadow
  - moon no longer visible

Conditions for an eclipse:
1. Phase of Moon:
   ➤ Moon must be New or Full Moon
2. Moon must be crossing the ecliptic
   - must have same declination as Sun
   - but, Moon’s orbit is tilted by ~ 5° from the ecliptic
Line of Nodes
- intersection of moon’s orbital plane and earth’s orbital plane

⇒ Line of Nodes must align with Sun

“Eclipse Season”
- occurs when line of nodes points to Sun
  – every 173 days (~ 5 ½ months)
Shadows

Shadow cast by an object with a small light source

**Umbra** – no light from source

Shadow cast by an object with a large light source
- Umbra narrows down to a point

**Penumbra** – receives some light from source, but not all

**Region of Transit** – receives light from all edges but not center of source
Lunar Eclipse

3 possible types of lunar eclipses:

View from Earth

Total Lunar Eclipse (path B):
- moon enters umbra completely
  - longest possible: ~ 1 h 42 min

Partial Lunar Eclipse (C):
- only part of moon enters umbra
Penumbral Lunar Eclipse (A):
- moon only enters penumbra
- very difficult to detect
Solar Eclipse

Type of eclipse:
- determined by part of shadow that hits the Earth
- determined by distance to Moon

Total Solar Eclipse:

sun is completely blocked out by the moon
- occurs when Moon closer to Earth
- shadow’s movement: path of totality

moon’s shadow moves across earth ~1000 mph
- longest possible totality ~ 7 min 30 sec

Partial Solar Eclipse:
- observers in penumbra only see sun partially blocked by the moon
Total Solar Eclipse
Partial Solar Eclipse
Annular Solar Eclipse:

- moon does not completely block sun
  → ring of sun visible around moon
- occurs when moon further from Earth
Total Solar Eclipse
Monday, 21 August 2017