**Lecture 12: Tides and eclipses**

* 1. Tides
     1. Source of tides
        1. Caused by Moon pulling harder on near side of Earth than Far
        2. Because of the Earth's rotation, this effect changes twice a day
        3. **Why twice a day not once?**
        4. Actually Sun has similar magnitude effect
     2. Periods of tides
        1. Period a bit longer than the day: **why?**
        2. Because Moon is orbiting
     3. Strength of tides
        1. Strength is set by how close moon is, how its forces line up with Sun, exact position on Earth
     4. **During what phases of the moon are tides most extreme?**
        1. New and Full, when Sun and Moon lined up
     5. **On what part of the Earth are tides strongest?**
        1. in Tropics, where Moon can be directly overhead
     6. **Are tides at Perigee or Apogee?**
        1. Perigee, by about 30%
        2. Because strength is 1/D^3 and 1/1.1^3 ~ 0.7
     7. The tidal bulge leads the Moon because of Earth's rotation, and gravitational forces from the bulge pushes moon outward, slows down Earth.
     8. **Why does moon get tidally locked?**
        1. Because tidal bulge on Moon has ALREADY slowed Moon down.
  2. Eclipses: basic dimensions involved
     1. Moon is right size and distance to eclipse Sun, and be eclipsed by Earth
     2. A coincidence that angular sizes are so similar, because when Moon was closer, would have been bigger.
  3. Shadows:
     1. **What does the Sun look like in the umbra?**
        1. Completely blocked!
     2. **In the penumbra?**
        1. With a bite taken out of it, or annular
  4. Solar eclipses
     1. **What does eclipse look like when Moon at apogee?**
     2. **How long does a total eclipse last for a given observer?**
  5. Lunar eclipses
     1. **How big is the umbra at the Moon?**
     2. **How long does a total LUNAR eclipse last?**
     3. **Are total lunar eclipses rarer or more common than solar eclipses?**
     4. **From where on Earth can you see a lunar eclipse?**
  6. Eclipse seasons
     1. **Why can't we see eclipses every new and full moon?**