ASTR 1001.2

Assignment 2

1. There are two problems with this misconception:
   a. First of all, typical spacecraft orbits are only a few hundred kilometers above Earth's surface, whereas the nearest celestial object, the Moon, is 384,000 km distant. Therefore there is very little reduction in our "closeness" to astronomical objects gained from using an orbiting telescope to view them.
   b. (BONUS). Since spacecraft orbit the Earth, there may be some directions when viewing celestial objects for which an Earth-based observatory is actually closer to the object than is the orbiting observatory (polar orbits, for example)

2. Stars emit light in similar fashion to black bodies. Every black body emits light at all wavelengths, according to its temperature. Hot black bodies emit more light in the blue spectral region than in the red spectral region, while cool black bodies emit more red light than blue light. Very cool stars with temperatures of 2500K emit light in the blue part of the spectrum as well as the red part. They emit more red light than blue light, so appear red in colour. But they also emit measurable amounts of blue light as well.

3. As parallax angles become smaller, they approach the precision limits of our measuring instruments. Since distant stars have very small parallax angles, the relative uncertainty in the measured distance, which is simply the ratio of the measuring uncertainty divided by the parallax angle, becomes larger and larger as the star's distance increases.

4. Because mass is related to luminosity for main-sequence stars, a knowledge of a star's spectral type is sufficient to infer a likely mass if it is also known to be a dwarf = main-sequence star. If a star's parallax is also known, its luminosity can be measured directly, and, if the star is not a supergiant or white dwarf, that also can be used to infer mass from the ML relation. Bonus. Any inferences based on stellar evolution or use of radial velocity wobble caused by an orbiting planet.

5. Stars cannot be smaller than ~0.08 $M_\odot$ because their cores never heat up to high enough temperatures for nuclear fusion to be sustained. Stars larger than ~100 $M_\odot$ produce so much thermonuclear energy that the radiation they emit overcomes the forces of gravity holding the star together, so they blow themselves apart.

6. Sunspots tell us that the Sun rotates on its axis about once every four weeks, but they also tell us that the Sun rotates differentially. It rotates faster at the Sun's equator than it does towards the poles, by several days in terms of the rotation period: ~25 days at the equator, >30 days at the poles.

7. The Sun's corona can only be viewed from Earth if the light from the photosphere can be completely blocked out. Special devices, called coronagraphs, allow us to see portions of the corona near the photosphere, but it takes a total eclipse of the Sun by the Moon to bring out all of the corona to our view.
<u>BONUS</u>. Features of the corona can also be seen in images of the Sun made using X-rays (orbiting telescopes) or from ground-based radio telescopes.

8. An O7 main-sequence star produces much more light in the far ultraviolet region than does a much cooler K0 supergiant. Thus, it produces more radiation capable of ionizing hydrogen atoms than does a K0 supergiant. The K0 supergiant produces more red light energy than does the O7 dwarf of the same luminosity.

9. As a protostar collapses to smaller dimensions, its central regions heat up to become hotter and hotter. At some point the gas becomes hot enough and dense enough for nuclear fusion to begin. That generates a considerable amount of energy which heats the gas further and generates a high enough pressure to balance the gravitational forces exerted by the rest of the star. The protostar therefore <u>never</u> collapses to zero radius.
<u>Bonus</u> Answers including the effects of angular momentum conservation and how it helps to oppose collapse.