Introductory High Points

This does not completely cover what we did in the first class, which was a rapid tour of three subjects:

- The daily and annual motion of the stars
- The RA/DEC Coordinate System
- The Magnitude System (including how color is defined using filters)

Instead it is some facts that might stand out and help you remember what we covered.

The daily and annual motion of the stars

- The Earth goes around the Sun once every 365.24 days. Usually, we just say 365.
- The Earth revolves on its axis once every 23 hours and 56 minutes and 4 seconds.
- If we round that down to 23 hours and 56 minutes, then we see that the Earth is revolving about 4 minutes too quickly each day.
- 4 minutes is slightly rounded up. Multiply that by 360 (which is slightly rounded down from the actual number of days per year). 4 * 360 = 1440. What is magic about that number? It is the number of minutes in a day. *In other words, the Earth revolves one extra time every year.
- We reconciled the number of times we spin on our axis in a year with the number of times we see the Sun. We understood why they disagree by exactly one day.

The RA/DEC Coordinate System

- We compared latitude with declination.
- Then we reviewed the arbitrariness of longitude (the 0° line of longitude goes through the Greenwich Royal Observatory)
- We need a zero of longitude in the sky? It is arbitrary.
- The place chosen is the First Point of Aries. It is where the Sun crossed from the south celestial hemisphere to the north celestial hemisphere (on the spring equinox) about 2,0000 years ago when the system was set up.
- The First Point of Aries is in Pisces. It is slowly moving toward Aquarius. It goes around once every 25,000 years just as a top slowly precesses on its axis.
- We discussed what declinations of stars are visible (above our horizon) at latitude 38°.

The Magnitude System (including how color is defined using filters)

- We discussed ranking things (like soccer players) to understand how they ended up assigning the *brightest* stars the *lowest* magnitudes.
- We discussed the need for magnitude 0 and magnitude -1.
- The modern magnitude system isn't just a ranking. It is a continuous scale. Every 5 magnitudes is a factor of 100 dimmer (if going up in magnitude) — or 100 brighter (if going down in magnitude)
- The magnitude of the Sun is -26.74 on the modern magnitude scale (I think I said -24 in class. Oops.)
- The Hubble can see to magnitude 30
- Our gear can get to magnitude 20
- The human eye can get to magnitude 5 at a very dark location with no Moon
- We discussed Vega as the reference star and that its magnitude was by definition 0.
- A basket of stars is now used instead of just Vega. "Alternatively, the zero-color standard can be defined to be the mean of a number of un-reddened A0 V stars of Pop I abundance, using the ensemble of Johnson-Morgan standards to fix the flux scale." If you want to know more about the basket (aka ensemble), you can read about it **here**. Now that an ensemble is used, Vega is at 0.03 rather than 0. This is too small of a difference for us to worry about for most purposes, so I usually just say that Vega is the reference star and has magnitude 0.
- Measuring a star's brightness is all about counting photons. If you put a filter on your scope, you are excluding some photons. We discussed how you still use Vega as the reference star (with the same filter!) if you are trying to define magnitude in a particular filter band.
- We discussed the perception of color (as an imbalance between the red, green, and blue channels), and how astronomers extend this idea of imbalance to astronomical filters.