3. FUNdamental Motions of the Sky Problems

One day while starting a class on introductory Astronomy I became upset with myself when the thought hit me that my students did not even understand the elementary motions of the Sun, Moon, and Stars. Thus I informed the students that we were not going to cover that day what was originally planned and instead were going outside for what turned out to be a sermon-on-the-mound experience. Once outside I had the students write down in their notebooks a heading of FUNdamental Motions of the Sky and the words DAY (at the top), (half way down the page) MONTH, (and toward the bottom of the page) YEAR. Reflecting on each of these three words can you determine how each influence the motion of the stars or moon both in degrees per day and/or hour and direction of the stars motion or and/or the moons motion.

Hints on next page.

Hints:

#1 what two simple motions does the Earth have in our solar system and what motion does the moon make in our solar system?

#2 360 degrees is the key to all three calculations.

#3 the directions can be figured out kinesthetically or an online sky map like heavens-above.com with their Whole Sky chart for any given date.

#4 look up star trail pictures or videos on the internet.

Answers on next page.

Answers:

#1

Magnitude of Motion that Causes the Day:

The day is caused by the Earth spinning 360 degrees in a 24 hour period thus 360 degrees/24 hours = 15 degrees per hour.

Direction of Motion that Causes the Day:

Kinesthetically let your standing body represent planet Earth. Figure out the direction by picturing a map of your region on the front of your shirt. Face so the east side of your region is facing east and spin your entire body making the Sun rise in the East. Note the Sun (and all stars) would appear to move opposite the spin of your body.

Note a star trail picture prove stars move in circles counterclockwise around the North Celestial Pole. Or just watch the stars over a period of a few hours on any given clear night.

#2 Direction of Motion that is caused by the Month:

Moons Magnitude: The Moon orbits the Earth 360 degrees in 29.5 days. If you round to 30 days, you'd get approximately 360 degrees/30 days = 12 degrees per day.

Moons Direction:  The Moon moves east near the Ecliptic (the apparent path of Sun through the sky but actually an extension of the Earth's orbit into the sky) can be proved by just watching where the moon is at a given time on two consecutive days.

#3 Stars motion caused by the Year:

Magnitude caused by the Year:  The Earth moves 360 degrees around the Sun in 365.24219 days.  360 degrees/365.24219 days ≈ 1 degree per day.

Direction caused by the Year:  Again the Earth spins toward the East, the Moon moves toward the East, and the Earth moves toward the East around the Sun making the stars appear to move about 1 degree per day counterclockwise around the North Celestial Pole.  (In the southern hemisphere stars would appear to move clockwise around the South Celestial Pole as you face south.)

This can be proved by going to a website like heavens-above.com and choosing their Whole Sky Chart for star formations at the same exact time over several days or months.