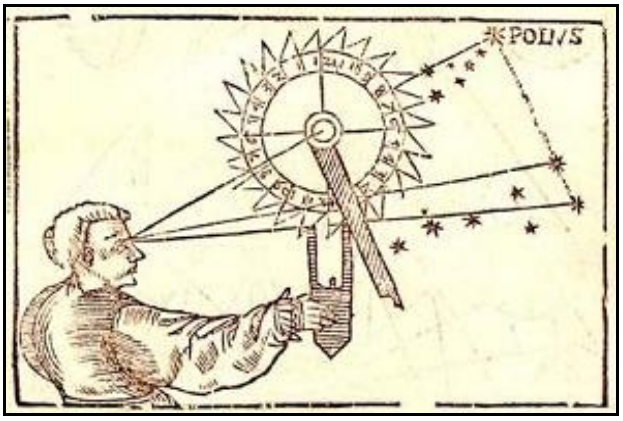
Name_____Date_____Period_____

Astronomical Measurement

Celestial Navigation

Background



By this point, you realize there are two distinctly different types of coordinates used by amateur and professional astronomers to identify an object's position in the night sky. As you delve more deeply into exactly how the sky moves and how to track objects, it is essential to master how each system works and their uses in specific skywatching situations. This lab will again use Stellarium with particular attention to the local and celestial grid coordinate systems.

1. Using the Stellarium software, set the map for a viewing session at Philadelphia on 17Nov09, 2000 hrs EST. Then, fill in the missing coordinates using software's search engines. For purposes of this lab, use the "On date" coordinates set. The difference between these coordinates and the "J200" coordinates can be explained this way. Before computer programs that can update celestial coordinates in real time existed, skywatchers had to rely upon periodic updates to the celestial coordinates of objects in the sky to correct for the Earth's subtle wobble and actual (albeit minute) motion of the object in space. These corrections were completed every 50 years so the last time coordinates were corrected was in the year 2000 hence J2000 (J=Julian year). Books written prior to 2000 would refer to 1950s corrections. Remember that each arc degree of declination in the sky can be subdivided into 60 "minutes" which can then each be divided again into 60 seconds which makes for very specific coordinates in the sky. This level of accuracy is necessary since even tiny errors in positioning could be enough to keep a distance object from appearing in a telescope's eyepiece. Right ascension follows the same system but divides the sky into 24 hours instead of 360º.

Object Name	RA/Dec*	Alt/Az#	Constellation
	RA: Dec:	Alt: ~30º Azm: ~55º	
Markab	RA: Dec:	Alt: Azm:	Pegasus
	RA: 04h 36' 28.34" Dec: +16º 31' 43.6"	Alt: Azm:	Taurus
Caph	RA: 00h 09' 40.56" Dec: +59º 12' 19"	Alt: Azm:	

*Very minor differences in RA/Dec coordinates are common based upon the exact source for information and its accounting of the Earth's 22,000 year precession cycle. Answers for these questions are always bright objects.

Provide specific coordinates, not estimates like the example provided.

2. On 06Oct95, the insignificant star 51Pegasi (51Peg for short) became famous practically overnight when Michel Mayor and Didier Queloz confirmed this otherwise boring, sun-like star had a planet orbiting it making it the first confirmed extrasolar planetary system in history. Their observations were made at the Observatoire de Haute-Provence (Haute-Provence Observatory). First, locate 51Peg on a star chart on that night at 2300 hrs CET (Central European Time) and then estimate the star's local and celestial coordinates. Then, pull up the data window for the star to see how close you were to the actual coordinates.

Once you've identified 51Peg, attempt to "estimate" the position of the star using just the gridlines and place your approximation in the Estimate boxes. Afterwards, check to see how close your estimates were. This will help you visualize the different grid systems.

Estimate	**Actual**
Altitude_____ Azimuth_____	Altitude_____ Azimuth_____
Declination_____ R. Ascension_____	Declination_____ R. Ascension_____

3. Find Altair, the alpha star in Aquila and write its coordinates below. Then, find what object and constellation lies on the complete opposite side of the celestial sphere. If that point in the sky does not contain a prominent* named star, choose the nearest one.
**Magnitude 2.0 or brighter.*

Altair: Dec_____ Opposite Altair (Const):_____

RA_____ Object*_____

4. At what coordinates (Alt/Az) does the sun reach its highest point in the sky during 2009 at Philadelphia? At the North Pole? (This is a *thinking* question...not just a "plug in the coordinates" question.)

Philadelphia	**North Pole**
Maximum Altitude_____ Azimuth_____	Maximum Altitude_____ Azimuth_____

What is the significance of the Sun's greatest altitude at the North Pole?

5. What special celestial event was visible in Orin, WY on 21Aug2017? At what precise times did this event begin and end and what azimuths marked these same locations/times?
*Answer must use 24 hour time and include time zone.

Event Type_____

Start Time*_____ End Time*_____

Beginning Azimuth_____ Ending Azimuth_____

6. The Great 2000 Freakout...As if the year 2000 was not chaotic enough, most major astronomical events lead to less scientific *astrological* projections of associated doom and gloom. To be honest, have you ever wondered why nothing *good* is ever supposed to happen during these events? Regardless, set the maps for 05May2000 at Philadelphia and see if you can identify the "apocalyptic" event that took place on that day. (Print and attach a map that illustrates the event...I.D. as **MAP 2**)

Type of event_____

In what constellation was this event centered?_____

What objects were involved in the event?_____

Once you have answered this question, Google the event and enjoy a few moments of lunacy by the catastrophists who thought the world was going to end.

7. Lets take a quick look at the ultimate pop culture astrological disaster...the end of the world. According to some *interpretations* of what is officially known as the Mesoamerican Long Count Calendar, the Winter Solstice of 2012 signified an alignment between three objects that would bring about a "transformation" according to the Mayans. Due to Earth's precession, this alignment only occurred once every 26,000 years. Align the map to this date and choose a location in the southern hemisphere where the sun is higher in the sky than it would be near Philadelphia. Take a look at RA: 18h Dec: -23.5^{o} and see if you can uncover what the New Age theorists were so afraid of.

What three objects lined up* to allegedly bring about the end of the world and why was this such an inredible calculation for the Mayans to make?

*For assistance, look up the "Great Rift" and see if you can identify what the Mayans were so interested in.