AN INTRODUCTION TO THE STARS AND CONSTELLATIONS

*TheSky X Serious*

Sky maps come in many types and shapes. Typical examples are the small, portable star wheel locator, the celestial globe with stellar objects distributed across the surface of a sphere, and the flat star map that is often published in astronomy magazines or mounted on the walls of classrooms. But there is also available astronomy software for the computer that can assist you in becoming more familiar with stellar patterns and their observed positions in the night sky. *TheSky X Serious* (hereafter referred to as *TheSky*) is one of these and an introductory exercise will let you begin to discover some of the many wonders of the day and night sky.

**An Introduction to *TheSky***

*TheSky* software by Software Bisque has been installed on the computers in the laboratory. The first thing to do is to access that software. The laboratory assistant can guide you initially or you can simply double-click on the appropriate icon and a star map should come up on the screen. There should also appear at the bottom of the screen a partial circle which represents your southern horizon. Above that horizon are displayed numerous celestial objects that you can observe with appropriate viewing equipment and clear sky conditions. Some of the objects are visible to the naked eye and some are not.

Before we begin you will need to load the ASTROLABSKYX1.skyx to set up the program for this exercise. Go to FILE, OPEN and select ASTROLAB1.skyx The file can be found on the desktop. Select OPEN and your star chart should reset.

At the bottom of the screen should be the following information. The look angle in degrees (or how much of the you actually see naked eye), the date, local time, location, your latitude and longitude and the right ascension and declination of the cursor position on the st Carmchart. Note the date and time. If the date and time require adjustment, access Date & Time from Input on the menu bar. A window will open on the left side of the screen for you to make necessary adjustments. Check, also, to see that the geographical location is set correctly. This is done through Input on the menu bar. If the
location is incorrect, then set it to Knoxville, Tennessee. The longitude of Knoxville is $83^\circ 55'$ W and the latitude is $35^\circ 57'$ N. Record the time, date, and location on the answer sheet at the end of this exercise for reference.

Examine the display of stars and note that there is a range of diameters of the circular dots that represent stars. This denotes the degree of apparent brightness of the individual stars. Only the brightest stars may be visible without use of a telescope. Change the directions of view to the east, then to the west, and finally to the north. This may be accomplished using the Look North, Look East, etc. buttons on the second line of the tool bar. These changes should show the prominent celestial objects that lie above the viewer's horizon in those various directions.

NOW RECORD ANSWERS TO THE FOLLOWING OBSERVATIONS ON THE ANSWER SHEET AT THE END OF THE LABORATORY EXERCISE.

1. Name 10 constellations that you should be able to observe on a clear evening at the specified time and date. Note: Constellation names can be obtained through Toggle Labels on the menu bar, and constellation lines can be accessed through Show Constellation Figures on the menu bar.

   Note any specific or prominent stars that may be a part of the constellations. You can identify the stars by a single-click of the pointer on the particular star. When you do this, much information is obtained about that star. This information will be very useful when stellar properties are investigated later.

2. Now set viewing for a date three months later, but leave the viewing time unchanged. Select INPUT from the top toolbar. Select DATE AND TIME. The Date and Time window will appear on the left side of the screen. Note which month is highlighted on the calendar. You may select any month by clicking on the month tab. The starchart will automatically shift to that date and time. List constellations which are still visible, those that have disappeared, and new ones that have become visible.

3. Set the screen for north viewing. Select Show Equatorial
Grid. There is a bright star very near the center of the starchart labeled Polaris. What is another name for Polaris.

4. Locate the constellation URSA MAJOR. What is the more common name for a star pattern within the constellation?

5. Where is POLARIS relative to the so-called pointer stars of the star pattern referred to in the previous question? Note: These pointer stars comprise the front edge of the dipper.

6. Where is the constellation CASSIOPEIA with respect to POLARIS and the BIG DIPPER? (Note: CASSIOPEIA and the BIG DIPPER form two opposing star groupings that are used in locating POLARIS. The location of CASSIOPEIA is especially useful in the fall when the BIG DIPPER lies near the northern horizon and is more difficult to locate.)

Now examine the directions in which the stars move during an interval of time. Advance the star field by one hour and again select the northern direction. Select DATE AND TIME from the INPUT on the top menu bar. The DATE AND TIME tool will open on the left side of the screen. Put the cursor on the hour and using the up arrow on the keyboard to move the time forward.

7. Did the BIG DIPPER move clockwise or counter-clockwise about POLARIS?

8. By what fraction of a revolution did it turn?

9. As a result of this observation, what is the relationship between one-hour time intervals and angle of rotation about POLARIS?

10. Click on the LOOK UP button. For a star initially overhead, would the direction of movement over the next hour be toward the west or toward the east?

In a period of slightly less than 24 hours (actually 23h56m), the stars return to their same observed positions. Consequently, the imaginary
sphere on which the stars seem to be fixed - called the CELESTIAL SPHERE - appears to rotate about an axis passing almost through POLARIS. There is a corresponding point located somewhere below our southern horizon for those observers in the southern hemisphere. This south celestial pole lies below our southern horizon by the same amount as POLARIS, or the North Star, lies above the northern horizon. The apparent motion of the celestial sphere is, of course, due to the daily rotation of the earth. Consequently, the earth's axis of rotation, when extended to intersect the celestial sphere, corresponds also to the axis of rotation of the celestial sphere. Once this concept is understood, it then follows that the earth's equatorial plane can be extended to intersect with the celestial equator. Viewing toward the south, locate this circle segment on TheSky projection. This line is projected upon the star field by selecting Show Equatorial Grid on the menu bar. The portion of the equatorial plane is that line segment designated by a declination of 0°. Change your horizon directions and note that the celestial equator intersects the horizon both due east and due west, irrespective of the star patterns visible.

11. For the date and time selected for question #1, list the significant visible constellations that are near the eastern and western horizons.

Finally, initialize the path of the ECLIPTIC on the star field through SHOW ECLIPTIC on the menu bar. This path also forms a great circle on the celestial sphere which represents the path of apparent motion of the sun during the course of a year. The circles of the ecliptic and of the celestial equator intersect at two points. The planes containing the two great circles are actually tilted by 23.5 degrees, the same angle by which the earth's axis of rotation is tilted away from the line perpendicular to its orbital plane about the sun.

12. Name the constellations that lie along the ecliptic from west to east. Can you relate these constellations to the constellations of the Zodiac?

Now adjust the time so that you observe the night sky at 9 pm each night for one week. The constellations and other celestial objects in the west move closer to the horizon on successive days. Consequently, as the days pass, western positioned celestial objects eventually disappear from
view for the same local time in the evenings. In contrast, objects which were just below the eastern horizon become visible as days pass. Another way of describing this concept is that objects rise a little earlier on consecutive days. This somewhat peculiar behavior is related to the apparent motion of the sun along the ecliptic.
INTRODUCTION TO THE STARS AND CONSTELLATIONS

Date: Time: Location:

1. Ten constellations Prominent associated stars

2. Date (Three months later):
   Constellations still visible:

   Constellations no longer visible:

   Newly observed constellations:
3. Star names:

4.

5.

6.

7.

8.

9.

10.

11. Eastern horizon: Western horizon:

12. Constellations along the ecliptic from west to east: