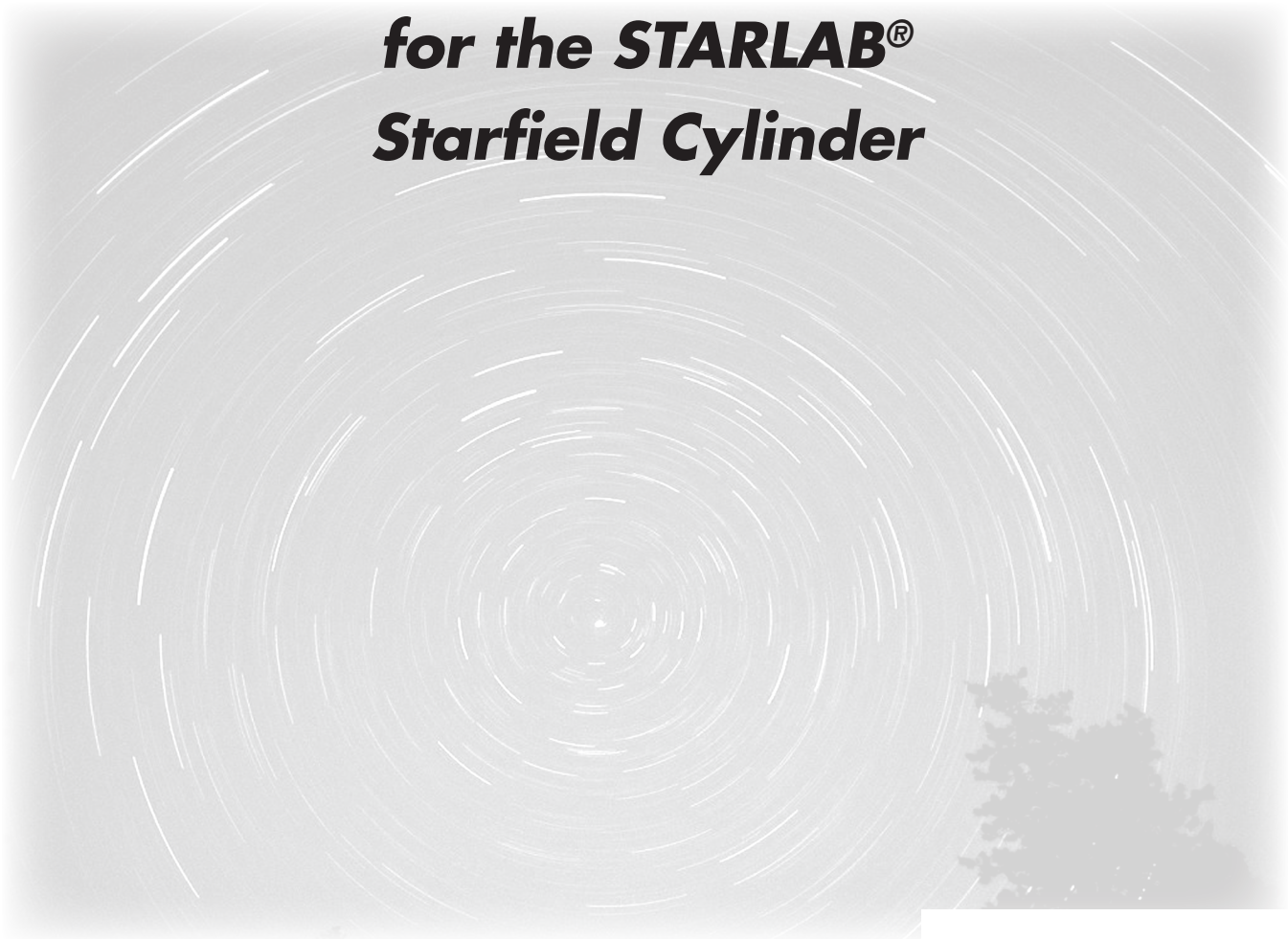


# ***A Collection of Curricula for the STARLAB® Starfield Cylinder***



*Including:*

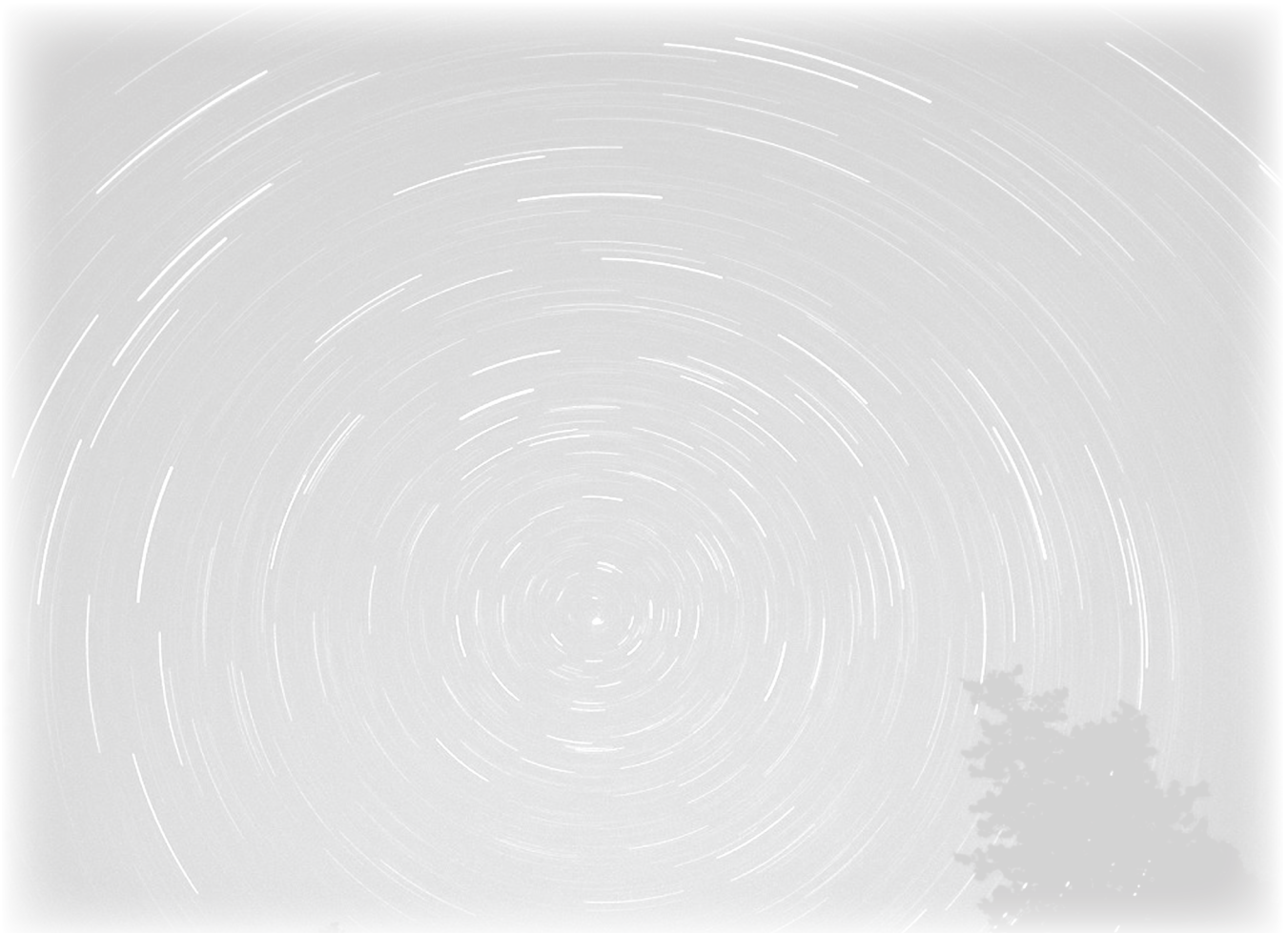
*A Look at the Starfield Cylinder by Joyce Kloncz*

*Motion of the Stars by Gary D. Kratzer*



## **Curriculum Guide Contents**

<i>A Look at the Starfield Cylinder</i> .....	3
<i>Motion of the Stars</i> .....	5
<i>Motion of the Stars: Worksheet 1</i> .....	8
<i>Motion of the Stars: Worksheet 2</i> .....	9
<i>Motion of the Stars: Worksheet 3</i> .....	10



# A Look at the Starfield Cylinder

by Joyce Kloncz

## Introduction

This cylinder is an excellent tool to teach beginning constellations to children. The following are some ideas you can use to introduce this cylinder.

## Objectives

To locate easy-to-find seasonal constellations and progress from season to season as students get older.

## Suggested Levels

K-6

## Process Skills

Describing • observing • interpreting • communicating • inferring • working cooperatively

## Procedure

- Explain to children as you ease the side lights down and the projector lights up, that the Starfield Cylinder shows 3000 stars, similar to the way we would see them far away from city lights. (It may be helpful to look at the Constellation Cylinder first, then to apply that knowledge to the night sky of the Starfield Cylinder.)
- With the youngest children, choose 2 or 3 easy-to-find constellations, such as Orion, Cassiopeia (the Lazy W), and Ursa Major. To familiarize children with the constellations, tell the Greek mythology story that goes with each constellation (see the Greek Mythology section). Point out where these 3 constellations are found on the Starfield Cylinder with the arrow pointer. Have the students close their eyes and then try to find the constellation in the STARLAB again when they open them.
- With older students, pass out the star map that goes with the season. Pass out red flashlights. Point out the cardinal directions of north, south, east and west in STARLAB. Have students work in teams and locate the constellations. (It works best if you assign constellations that are across from where they are sitting in STARLAB, rather than behind them.) Give a group of students the northern constellations, a group the southern constellations, a group the eastern constellations, and a group the western constellations. Have students hold their star map with the direction they will be looking toward next to their body. Then look at the constellations right above the horizon on the star map, and look across STARLAB to find their assigned constellations.

The following are major constellations in the four seasons that students can identify:

- Winter: Orion, Gemini, Auriga, Taurus, Canis Major, Canis Minor, Cassiopeia, Ursa Major, Ursa Minor
- Spring: Leo, Boötes, Virgo
- Summer: Sagittarius, Scorpius, Cygnus, Lyra, Aquila
- Fall: Pegasus, Andromeda

## MATERIALS

- STARLAB Portable Planetarium
- Starfield Cylinder
- seasonal star maps
- arrow pointers
- red flashlights (for reading)

For constellations with bright stars, identify the major stars, such as:

- Orion: Betelgeuse, Bellatrix, Rigel, and Saiph
- Gemini: Castor and Pollux
- Taurus: Aldebaran
- Auriga: Capella
- Canis Major: Sirius
- Canis Minor: Procyon
- Leo: Regulus
- Boötes: Arcturus
- Virgo: Spica
- Scorpius: Antares
- Cygnus: Deneb
- Lyra: Vega
- Aquila: Altair

For older students, use the star maps and write the name of the bright stars near its constellation.

Other constellations in the night sky are difficult for children to see, so choose those that children can successfully find. After students have worked in teams, pass out the arrow pointers and have individual students locate the constellations in STARLAB. It is helpful to have younger students look for only one season of constellations. In about third grade add a second season, in fourth grade add a third season, and in fifth grade add the fourth season. In that way, they will build on past knowledge.

Point out other features in the sky, such as:

- the Winter Triangle, with Betelgeuse, Procyon, and Sirius
- the Summer Triangle, with Vega, Deneb, and Altair
- how to “Follow the Arc to Arcturus and Speed on to Spica”
- how to star hop from constellation to constellation to make finding them easier. (See star hopping tips in the Constellation Cylinder curriculum.)

#### **Evaluation**

Have students show you the constellations with the arrow pointer.

#### **Note**

*Use the CD or audio cassettes “Tours of the Night Sky” (included with this guide) as an excellent method of preparation for teaching children how to locate constellations and stars.*

# Motion of the Stars

by Gary D. Kratzer

## Objectives

Assessment of student knowledge of the night sky by observing apparent star motion from different locations on earth.

## Preparation

Before attempting to study difficult concepts in astronomy, it is imperative to assess student knowledge of the night sky to identify any student misconceptions that may exist. This activity will reveal such problems and establish a solid foundation on which to build future concepts and understanding in the student.

## Procedure

1. Once the students have entered the STARLAB and are seated (consider a possible arrangement for some students), pass out clipboards and marking pens to each student.
2. Engage the students in a discussion about any experiences they may have had with viewing the night sky. Explain to the students that Worksheet 1 shows semi-circle views that represent a part of the dome that they will be observing and are so indicated with letters that represent the direction. (Example: E = East). Explain that on the worksheet that contains the 8 semi-circular drawings, the bottom of each represents the horizon and the curved part represents the boundaries of the sky (planetarium dome) that they are to focus their observations in.
3. Have all of the students face north in the planetarium. Make sure every student is physically positioned to face north conveniently! If the class has fewer than 20 students or so, have them move to the southern part of the dome to avoid sitting directly under the northern wall of the planetarium.
  - Repeat this procedure when observing apparent motion of stars from different directions.
4. Tell the students to imagine that they are observing on a clear dark night. Due to the fact that the projector can speed up time, we will be observing several hours of apparent star motions (one starfield rotation in four minutes is equal to 24 hours of real time or 10 seconds equals 1 hour).
5. By drawing arrows in the appropriate dome drawings on Worksheet 1, the students will indicate the apparent direction of star motion. Have each student make a prediction as to what he/she believes the apparent motion will resemble when looking north over a substantial period of time. Tell the students they are to work individually. Use arrows to indicate those directions in the part of the worksheet labeled "Prediction."
  - Keep in mind that many students will mark randomly until they better understand what is about to happen. Perhaps the students are really guessing as opposed to predicting. Many of your students have never done anything remotely like this in the night sky.
6. Set the star projector to your latitude. Turn down the side lamps (right knob) on the projector while slowly increasing the brightness of the starfield (left knob). After the students are all facing north, point to a bright star to the left of the North Star and turn on the daily motion motor.

## MATERIALS

- STARLAB Portable Planetarium
- Starfield Cylinder
- direction markers (N,S,W,E)
- clipboards
- overhead transparency marking pens
- copies of Worksheets 1 and 2

- The bowl of the Big Dipper can be used to locate the North Star. The two “end of the bowl” stars are also known as the “pointer stars.” Follow these stars to the first moderately bright star due north. This should be Polaris or the North Star.

**Note**

*Keep the pointer stationary while the starfield “actually moves” thus creating a fixed reference point to compare the motion to.*

- Remind your students that unlike the real sky where apparent star motions are due to the rotation of the earth, the Starfield Cylinder is actually moving the stars!
  - Some students will say that in the first observation the stars moved up. Some will attempt to use directions to explain what they have observed.
8. Next move the pointer to a bright star just above the North Star. Turn on the daily motion switch. Allow the students time to make an observation. After a few moments turn off the daily motion switch and solicit student explanations of their observations.
    - Some students will say that in the second observation the stars moved to the left or west.
  9. Next move the pointer to a bright star just to the left of the North Star. Turn on the daily motion switch. Allow the students time to make an observation. After a few moments turn off the daily motion switch and solicit student explanations of their observations.
    - Some students will say that in the third observation the stars moved down. Some will attempt to use directions to explain what they have observed.
  10. Next move the pointer to a bright star just below the North Star. Turn on the daily motion switch. Allow the students time to make an observation. After a few moments turn off the daily motion switch and solicit student explanations of their observations.
    - Some students will say that in the fourth observation the stars moved to the right or east.
  11. For the last observation move the pointer to the North Star.

**Note**

*Avoid telling the students the name of the star at this time!*

12. Turn on the daily motion switch. Allow the students time to make an observation. After a few moments turn off the daily motion switch and solicit student explanations of their observations.
  - Some students will say that in the fifth observation the star did not move.
13. Ask the students what a good name would be for this star (North Star). Lead a discussion that will reveal the correct apparent motion of that part of the sky.
  - The students should rationalize that due to the observations made looking north, the stars seem to revolve around one stationary star, “Polaris or the North Star.” The farther away from Polaris the bigger the circling appears to get until some stars actually appear to dip below the horizon. The direction of rotation is counter-clockwise.
14. After an agreement is reached on the correct apparent motion of the stars looking north, have the students draw the correct answer in the part of Worksheet 1 entitled “Results.” Make sure the students know what to draw by walking around the dome using the partial floor near the wall as a walkway. When the students

have the results recorded, have them write a brief explanation of what they have observed about the stars in the north under the column entitled "Analysis of Observations."

- Ask the students how their predictions matched up to the results.

15. Now repeat the above mentioned procedures for the remaining directions of south, east and west.

#### **Note**

*Have the students make only one observation in each direction using the pointer as a fixed reference point. Remind your students that they are to make a prediction first and that they are to work individually. Remember that each student must be seated facing the direction he/she will be observing!*

16. After each observation is made, ask the students how their predictions matched the results. Remind the students that such observations are not an everyday occurrence but that an understanding of the world around them is important to be able to understand other concepts that will be covered when studying astronomy in the planetarium.

17. Review all of the correct "Results" of the observations.

18. Collect all of the marking pens and clipboards as the students exit the dome one at a time. Make sure you are the last person to exit the dome.

#### **Extensions**

- Adjust the projector to  $0^\circ$  latitude to simulate the apparent star motions as seen from the equator. Have the students imagine that they have quickly traveled to the equator and have arrived on a clear dark night. Hand out Worksheet 2 and repeat the previous procedures for observing in the various directions. Follow the instructions on the worksheet. Be sure to stimulate a discussion of the results and a review of the answers at the end of the lesson.
- Adjust the projector to  $90^\circ$  latitude to simulate the apparent star motions as seen from the North Pole. Have the students imagine that they have quickly traveled to the North Pole and have arrived on a clear, cold, dark night. Repeat the previous procedures for observing in the various directions. Follow the instructions on Worksheet 3. Be sure to stimulate a discussion of the results and a review of the answers at the end of the lesson.

## Motion of the Stars: Worksheet 1

**Instructions**

Draw arrows in the models of the dome below to indicate the direction of apparent star motions as seen from **your latitude**. First draw a prediction indicating how you think the stars will appear to move while looking in a specific direction. After observing the apparent motion of the stars in a specific direction, draw the results and the analysis of the observation to the right of the results column.

Prediction Looking North	Results Looking North	Analysis of Observation

Prediction Looking South	Results Looking South	Analysis of Observation

Prediction Looking East	Results Looking East	Analysis of Observation

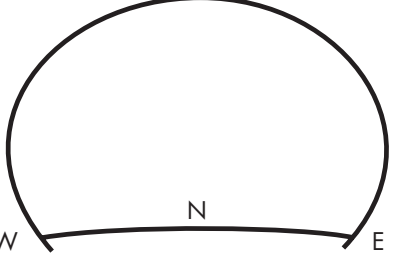
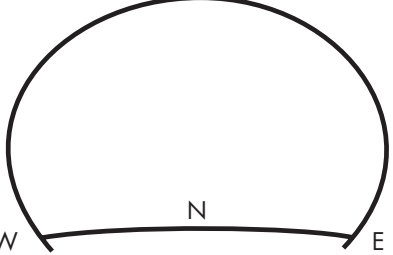
Prediction Looking West	Results Looking West	Analysis of Observation

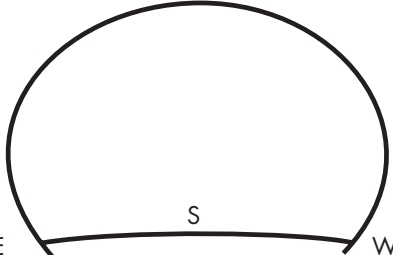
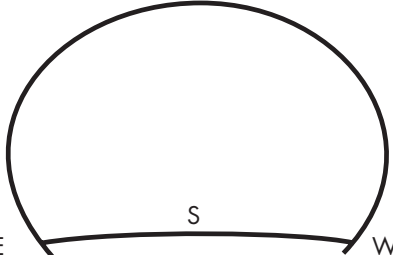


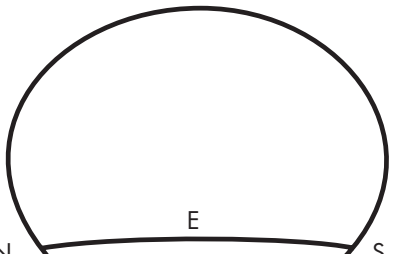
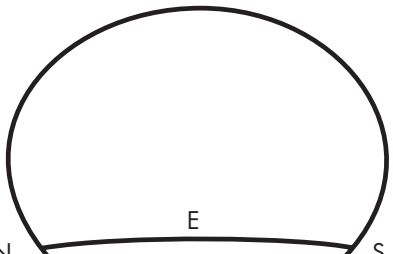
## Motion of the Stars: Worksheet 2

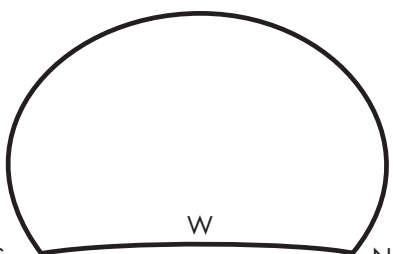
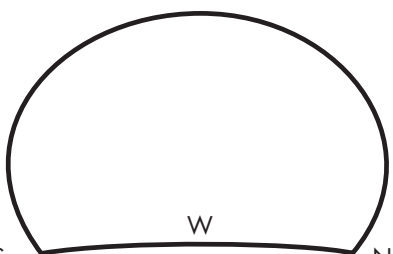
**Instructions**

Draw arrows in the models of the dome below to indicate the direction of apparent star motions as seen from **the equator**. First draw a prediction indicating how you think the stars will appear to move while looking in a specific direction. After observing the apparent motion of the stars in a specific direction, draw the results and the analysis of the observation to the right of the results column.

Prediction Looking North	Results Looking North	Analysis of Observation
		

Prediction Looking South	Results Looking South	Analysis of Observation
		

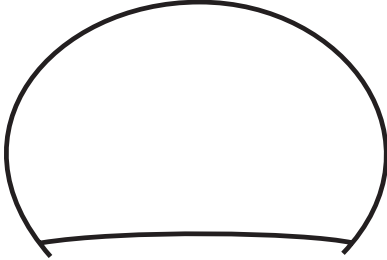
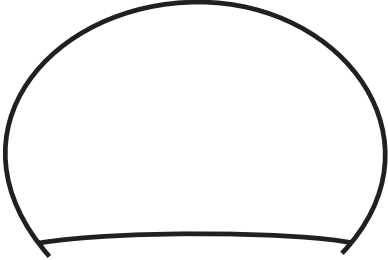
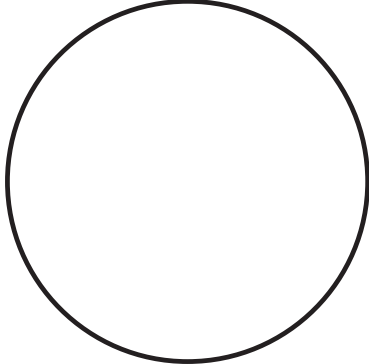
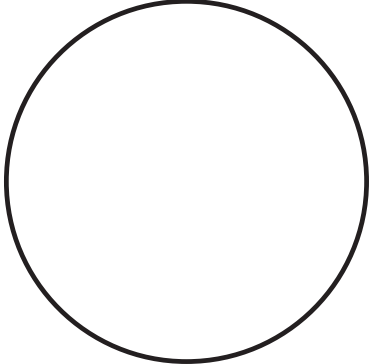
Prediction Looking East	Results Looking East	Analysis of Observation
		

Prediction Looking West	Results Looking West	Analysis of Observation
		

### Motion of the Stars: Worksheet 3

**Instructions**

Draw arrows in the models of the dome below to indicate the direction of apparent star motions as seen from **the North Pole**. First draw a prediction indicating how you think the stars will appear to move while looking in a specific direction. After observing the apparent motion of the stars in a specific direction, draw the results and the analysis of the observation to the right of the results column.

Prediction Looking in Any Direction Toward the Horizon	Results Looking in Any Direction Toward the Horizon	Analysis of Observation
 A diagram of a dome, represented as a semi-circle with a curved bottom edge. It is intended for drawing arrows to predict star motion.	 A diagram of a dome, identical in shape to the prediction diagram, intended for drawing arrows to show observed star motion.	
Prediction Looking Straight Up at the North Pole	Results Looking Straight Up at the North Pole	Analysis of Observation
 A simple circle diagram intended for drawing arrows to predict star motion when looking straight up at the North Pole.	 A simple circle diagram, identical to the prediction diagram, intended for drawing arrows to show observed star motion.	