

On the SCOPE skies

Most people don't realize the Earth wobbles; it's hard to notice unless you study the skies.

Perpetual motion

As the world turns, so does the sky, or so it appears to us from Earth. Our perspective of the sky is based in part on the Earth's regular motions. Most of us are familiar with the concepts of rotation and revolution. Not everyone, though, is familiar with the less-perceptible Earth motion of precession.

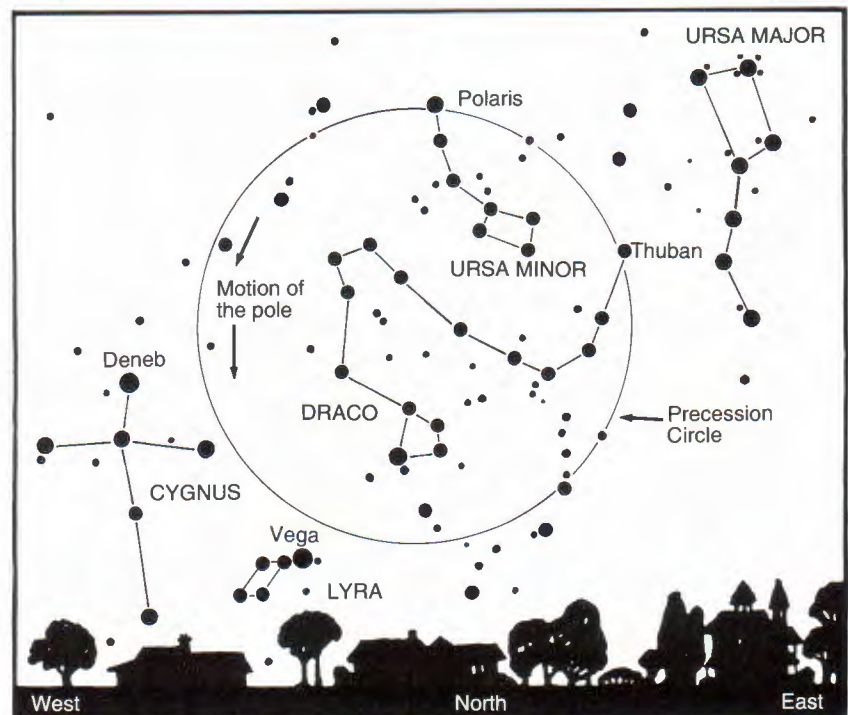
The Earth wobbles about its axis much the way a gyroscope does as it slows down. However, unlike a gyroscope, the Earth spins very slowly and will not stop spinning and topple over. The Earth's wobbling motion is referred to as precession, or the shifting of the Earth's axis over time. The wobbling is caused by a combination of its 23.5° axial tilt from the plane of the solar system, and the gravitational pull of the Sun and the other planets back toward the plane of the solar system. Because of the Earth's rotational spin, it, like a gyroscope, resists outside forces, and does not align itself with the solar system.

The changing skies

Precession is a slow but steady motion. The completion of one cycle takes about 25,800 years. As the Earth precesses, our view of the sky slowly changes, so that after a long period of time, the stars and constellations shift their positions in the skies relative to the Sun.

Ancient cultures kept track of time by noting the Sun's position with respect to the constellations. For example, the start of each season was identified by the Sun's position within a constellation's

Figure 1.



Max-Karl Winkler

boundaries. (See Table 1.) However, due to precession of the Earth's axis, this start position has shifted over the centuries.

One very straightforward way to visualize the changes caused by precession is to think about how the position of the Celestial Pole (the point in space directly over the North Pole) moves with respect to the background stars. (See Figure 1.) As the Earth precesses, the North Pole traces out a circle in the

night skies, as does the South Pole.

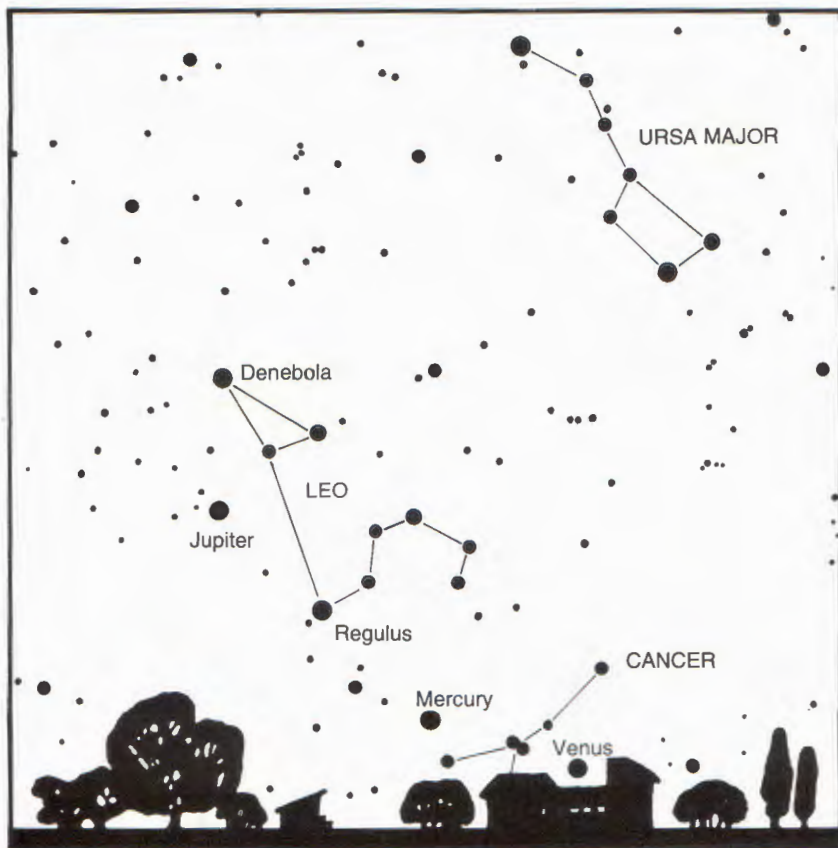
Presently, the Earth's North Pole points almost directly towards the star Alpha Ursa Minor, commonly known as Polaris the North Star. Polaris is less than one degree from the North Celestial Pole. However, Polaris has not always been our North Star, nor even our brightest polestar.

Here's a snapshot of the North Pole's movement during the most recent 2/3 of a precession cycle. About 17,000 years ago, the North Celestial Pole pointed to within a few degrees of the bright star Deneb, the top of the cross-shaped constellation, Cygnus the Swan. Approximately 4,000 years later, the North Celestial Pole was within a few degrees of the very bright star Vega, in the constellation of Lyra the Harp. Around 2700 B.C., the star Thuban, in Draco the Dragon, was the Pole Star.

Table 1.

Sun's constellation position for start of each season

Season (northern hemisphere)	Constellation (1000 B.C.)	Constellation (2000 A.D.)
Spring (March)	Aries	Pisces
Summer (June)	Cancer	Taurus
Fall (September)	Leo	Virgo
Winter (December)	Capricorn	Sagittarius



LOOKING WEST ABOUT 9 P.M. ON JULY 15, 1992.

Summer planets

Over the summer, you will have several chances to observe some of the planets and follow their orbital motions about the Sun. The visible planets will be grouped on either side of the sky, some of them setting while others are rising. The star chart shows a generalized view of the sky facing west. Prominent is the planet Jupiter, setting about an hour after Venus. In between these two bright planets is the dimmer Mercury.

By observing this area of the sky at approximately the same time in the evening over the course of the summer, some of the planets' motions will become apparent. Watch for Mercury to pass Venus and Jupiter during July. Venus will close in on Jupiter, and by the end of August, the two planets will set together. They will be closest together on the night of August 22. Watch for the new crescent moon to be near the two on August 29.

Over the eastern horizon, at sunset, the planet Saturn rises into view. Over the summer, Saturn will appear higher and higher over the eastern horizon and, by August, will be visible all night long. To the east of Saturn are two more planets, Uranus and Neptune, which are difficult to see without dark skies and binoculars. Uranus and Neptune are located within the boundaries of Sagittarius. On the nights of June 17, July 16, and August 10, the nearly full moon will pass by these two outer planets.

Visible planets (June-August)

Mercury: Low over the horizon after sunset (June and July)

Mars: Over east-southeast horizon before sunrise.

Jupiter: Over southwest-west horizon after sunset.

Saturn: Over east-southeast horizon after sunset.

Moon phases

June

New Moon - June 1
 First Quarter - June 7
 Full Moon - June 15
 Last Quarter - June 23
 New Moon - June 30

July

First Quarter - July 7
 Full Moon - July 14
 Last Quarter - July 22
 New Moon - July 29

August

First Quarter - August 5
 Full Moon - August 13
 Last Quarter - August 21
 New Moon - August 28

Bob Riddle is the planetarium director of the Kansas City School District at Southwest Magnet Math & Science High School.

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