

### Offered Title: The Changing Circumpolar Sky

Our world turns, spins on an imaginary axis that goes through the south and north poles. Hey, that's why they're called poles!

Earth's rotation axis is changing, and we will change with it. Fortunately for us the change is very slow so most humans should be able to adapt. That is, if we're still around in thousands of years.

Earth spins like a huge wobbly top in slow motion. This wobble, termed precession, causes our north and south polar axes to slowly circle around. Slowly in that it takes about 22,700 years to complete one circle. Earth wobbles and orbits around the Sun and our solar system orbits the center of our Milky Way galaxy and our galaxy is moving around the universe. You might surmise this movement traces invisible spirograph-like arcs on the celestial sphere, but no spirograph.

All this spinning, wobbling, and moving looks like, well, a simple circle on the celestial sphere. Why? Because everything beyond our solar system is so incredibly far that all this movement is miniscule by comparison so we cannot detect the ever so tiny arcs along the circle. Kind of like digital camera resolution. You don't see individual pixels in an image because they are so tiny. The arcs made by Earth, the solar system, and our galaxy moving are orders of magnitude smaller than pixels by comparison with the universe. So, bla-bla-bla, the wobble forms an invisible circle on the celestial sphere.

Right now, the north polar axis points toward Polaris. You might think Polaris will always be the pole star because it is named Polaris, right? Polaris is a renaissance era name derived from *Stella Polaris* because that star was closest to the northern celestial pole. As the polar axis traces a circle other stars become the "north star" if they are close to the circle.

Earth's precession causes the pole star to change over time. It also causes the constellations that never set, or circumpolar constellations, to change. All constellations/celestial objects appear to circle around the pole star/celestial axis, but circumpolar objects are close enough to the celestial pole that they never dip below the horizon. They can be seen any time of year. Many constellations farther from the pole are below the horizon for part of the year. That's why we have seasonal constellations.

Circumpolar constellations north of the equator are Ursa Major, Ursa Minor, Cassiopeia, Cepheus, Draco, and Camelopardalis. For anyone north of the equator they never entirely set. The farther north you go, the more northern circumpolar constellations there are. Same for the southern hemisphere. At the poles, all constellations above the respective celestial equator for that hemisphere are circumpolar.

### What's in the Sky?

June 10; sunset; east: Watch Jupiter rise as the Sun sets. It's at opposition (like every full Moon). Jupiter will be big and bright for months.

June 15; after sunset; southeast: The Moon, Jupiter, and Antares make a triangle.