

KNOWING THE HEAVENS

Chapter 2

INTRODUCTION The sky has a very dynamic appearance. The nightly, weekly, monthly, and yearly changes in the appearance of the night sky are, however, very predictable and most are dependent on the observer's location on Earth. There are also changes that happen relatively quickly (*e.g.*, the motions of some of the planets against the backdrop of stars) and others that happen very slowly (*e.g.*, the precession of the equinoxes and the proper motions of the stars). Ancient astronomers on nearly every continent observed and characterized these motions and used them to set their calendars for planting, harvest, religious ceremonies, and cultural events, just to name a few. The ancient astronomers also saw religious and cultural icons in the stars, many of which today make up part of the 88 established constellations.

- GOALS**
- ✓ The celestial sphere is a convenience used by astronomers for describing positions and motions of the celestial objects. The celestial sphere is characterized by the coordinate system of right ascension and declination, a coordinate system analogous to the terrestrial system of latitude and longitude. In fact, nearly this entire chapter is devoted to understanding the 3-dimensional geometry of the apparent night sky.
 - ✓ Understand that the day-to-day appearance of the night sky changes. All celestial objects appear to rise in the east and set in the west. Stars observed at the same time will appear to have moved 4 minutes to west each night.
 - ✓ The axis of the Earth is tilted by 23.5° from the ecliptic. It is this tilt that causes the seasons.
 - ✓ The axis of the Earth precesses. It is 26,000 year precession that causes the precession of the equinoxes and the changing of the pole star over the millennia.
 - ✓ Always remember that the observed stellar and solar motions are a result of the Earth's rotation and revolution. The motions of the planets against the backdrop of the stars is due to their revolution around the Sun (except when they are in apparent retrograde motion).
 - ✓ Time keeping is usually a difficult concept. It is important to understand the differences and origins of the mean solar day, sidereal time, local time, coordinate universal time (UTC), standard and daylight-savings time, and the sidereal and tropical year. Later, another time - synodic period - will be added to the list.
 - ✓ Many celestial and terrestrial terms are used routinely. Mastery of these are important. Examples include, but are not limited to, latitude/longitude, declination/right ascension, meridian, transit, celestial pole, celestial equator, and ecliptic.

DEFINITIONS

You should have a working knowledge of at least these terms and any others used in lecture and lab. Many of these terms will be found in the glossary at the class website.

analemma	epoch	prime meridian (terrestrial)
Antarctic circle	equinox (autumnal and vernal)	right ascension
apparent solar day	latitude/longitude	sidereal day
apparent solar time	leap year	sidereal time
Arctic Circle	mean solar day	sidereal year
asterism	mean sun	solstice (winter/summer)
celestial equator	meridian	time zone
celestial sphere	north/south celestial pole	transit
circumpolar stars	precession	Tropic of Cancer
constellation	precession of the equinoxes	Tropic of Capricorn
declination	prime celestial meridian	tropical year
diurnal motion		zenith
ecliptic		zodiac