

Celestial Sphere, Solar Motion, Coordinates

Lecture Outline -- 1

Reading: *Astronomy Notes* sections 3.1 through 3.5

Vocabulary terms used:

celestial poles—points on celestial sphere directly above geographic poles.

celestial equator—circle around the sky directly above the Earth's equator.

zenith—point on the celestial sphere that is *always* straight overhead.

meridian—circle around the sky that goes through celestial poles *and* the zenith point.

Separates the daytime motions of the Sun into “a.m.” and “p.m.”.

solar day—time between successive meridian crossings of the Sun. Our clocks are based on this.

ecliptic—the apparent yearly path of the Sun through the stars on the celestial sphere. It is the projection of the Earth's orbit around the Sun onto the celestial sphere.

vernal equinox—specific moment in the year (on March 21) when the Sun is directly on the celestial equator, moving north of the celestial equator.

autumnal equinox—specific moment in the year (on September 22) when the Sun is directly on the celestial equator, moving south of the celestial equator.

season—approximately three-month period bounded by an equinox and a solstice.

solstice—specific moment in the year when the Sun is farthest away from the celestial equator. The summer solstice is when the Sun gets closest to zenith at noon (on June 21 for U.S.). The winter solstice is when the Sun gets closest to the horizon at noon (on December 21 for U.S.).

latitude—used to specify position on the Earth, it is the number of degrees north or south of the Earth's equator.

longitude—used to specify position on the Earth, it is the number of degrees east or west of the 0° line going through Greenwich, England.

altitude—position on the celestial sphere that is the number of degrees above the closest horizon.

azimuth—position on the celestial sphere that is the number of degrees along the horizon away from the exact north point.

right ascension (RA)—position on the celestial sphere measured with respect to the celestial equator. It is a projection of longitude lines onto the sky and converted to time units. An object's RA is fixed throughout the night.

declination (dec)—position on the celestial sphere that measures the number of degrees north or south of the celestial equator/ It is a projection of latitude lines onto the sky. An object's dec is fixed throughout the night.

precession—slow wobble of an object's rotation axis or an object's orbit. For the Earth, precession is caused by the gravitational pulls of the Sun and the Moon on the Earth's equatorial bulge.

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Lecture Outline -- 2

Outline

A look at the sky

Reference markers (definitions)

Motion of stars with respect to celestial equator _____

Points on horizon the celestial equator *always* goes through _____

Views from various places on the Earth.

Height of celestial pole above horizon = _____

Motion of the Sun

Ecliptic is tilted by _____ with respect to celestial equator

Places ecliptic and celestial equator intercept _____

Length of daylight when Sun on celestial equator _____

Where on horizon Sun rises and sets on those dates _____

How far Sun is from celestial equator at solstices: _____

Where on horizon Sun rises and sets in spring and summer _____

Why daylight is longer than 12 hours in spring and summer _____

Where on horizon Sun rises and sets in fall and winter _____

Why daylight is shorter than 12 hours in fall and winter _____

Coordinate Systems

Altitude-azimuth

Depends on _____

Azimuth of sunrise in spring and summer _____

Azimuth of local noon at any time of the year _____

Azimuth of celestial equator in east _____ and in west _____

Altitude of celestial equator where it crosses meridian _____

Altitude of Sun at local noon in spring and summer _____

Altitude of Sun at local noon in fall and winter _____

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Lecture Outline -- 3

Right ascension-declination

Why used _____

Right ascension is like _____

How right ascension is measured (units) _____

Two stars that are 1 hour of RA apart will rise _____

Declination is like _____

How declination is measured (units) _____

Declination of Sun at equinoxes _____

Declination at solstices _____

Precession

How Earth is like a spinning top or gyroscope _____

Star positions over long time periods _____