Imaging with *SPIRIT*

Celestial coordinates

The night sky can be thought of as a celestial sphere—an imaginary orb that surrounds the Earth upon which all astronomical objects are positioned.

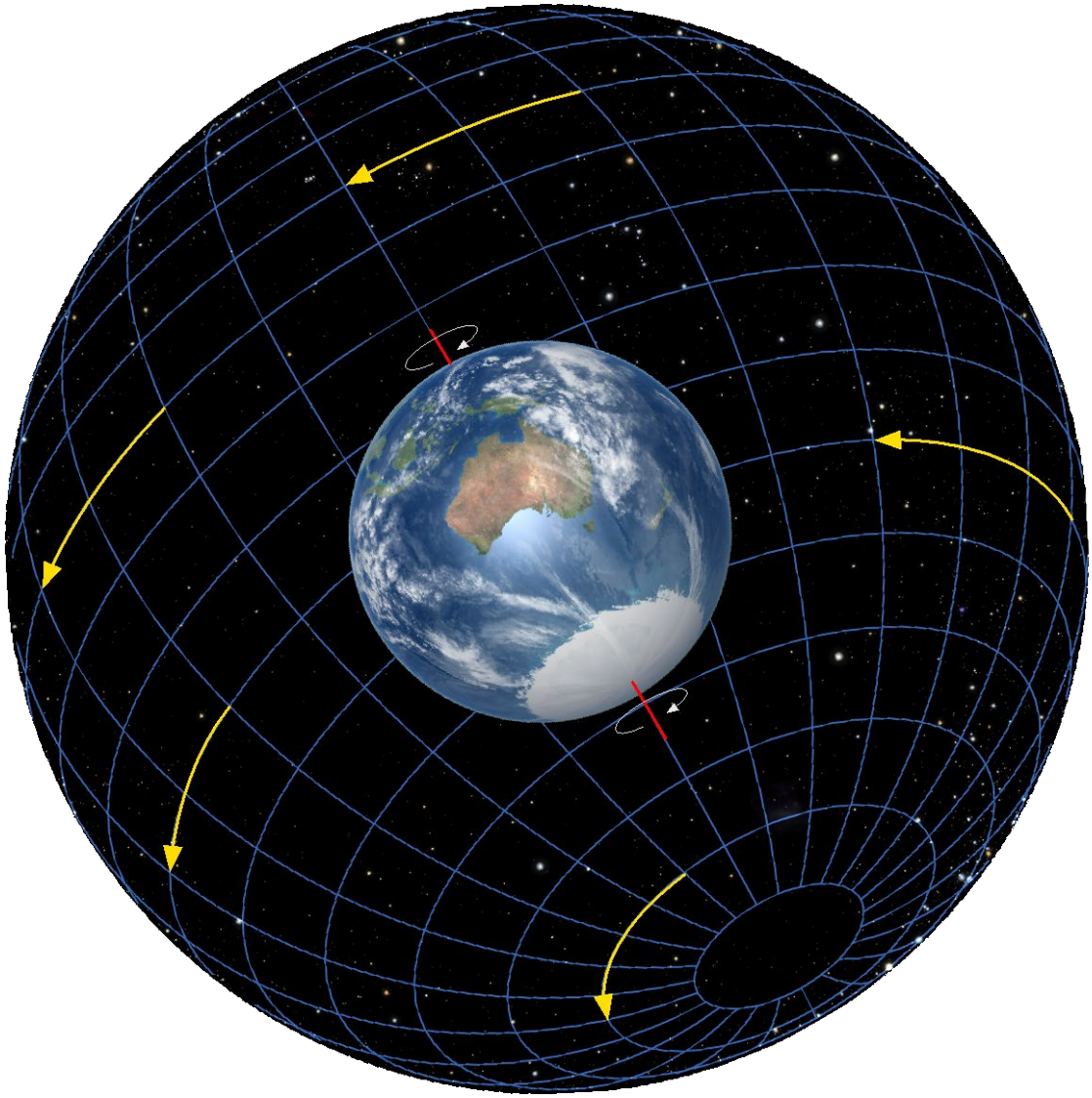


Figure 1: The celestial sphere

The Earth rotates on its axis once per day from west to east. This accounts for the apparent motion of the stars across the sky from east to west.

Astronomers map the sky using a coordinate system equivalent to Earth's longitude and latitude. Celestial longitude is called **right ascension** (RA) and celestial latitude is called **declination** (DEC). Just like cities and towns on Earth, objects in the night sky can be specified according to their coordinates.

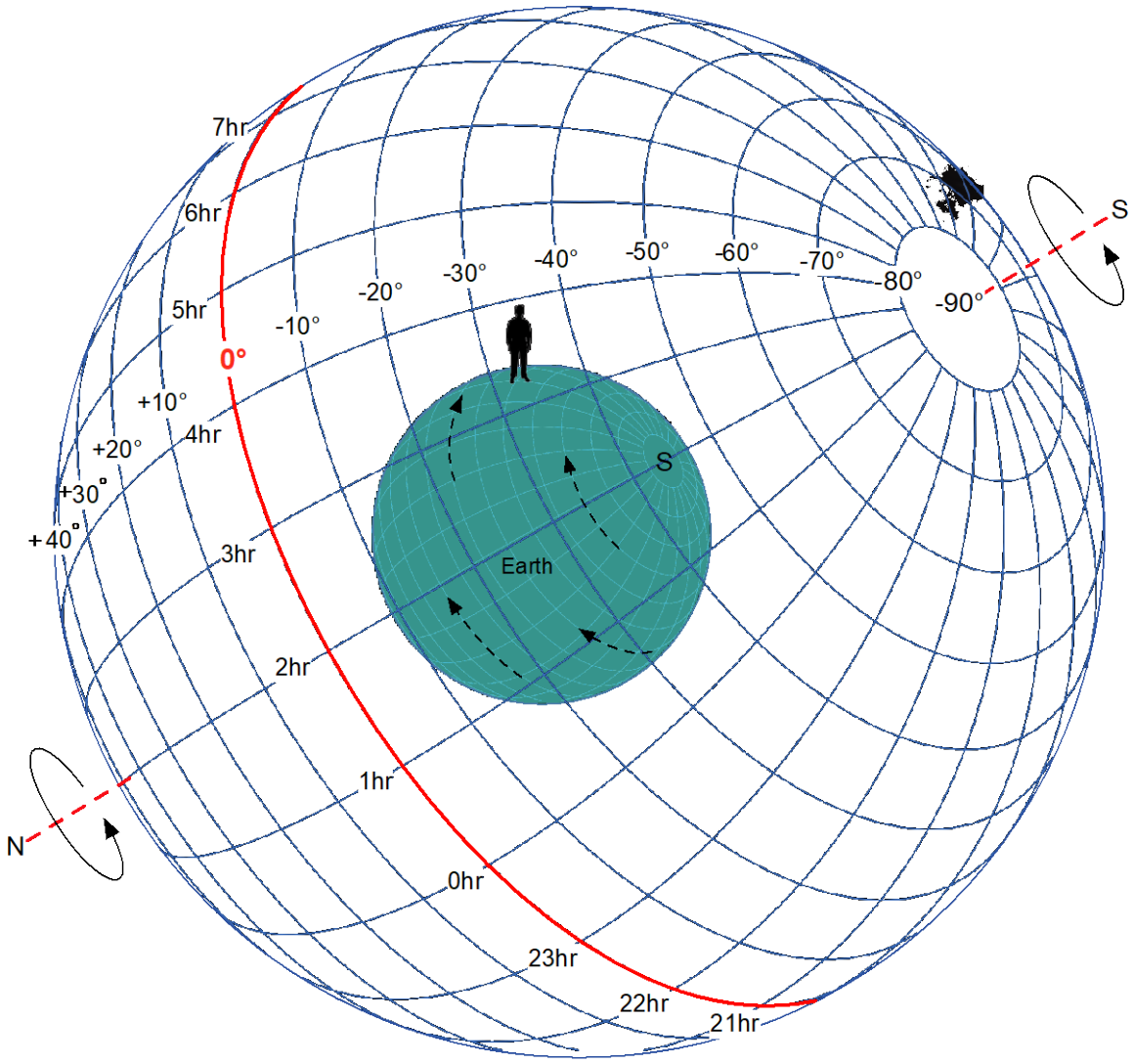


Figure 2: Lines of RA and DEC viewed by an observer in the southern hemisphere.

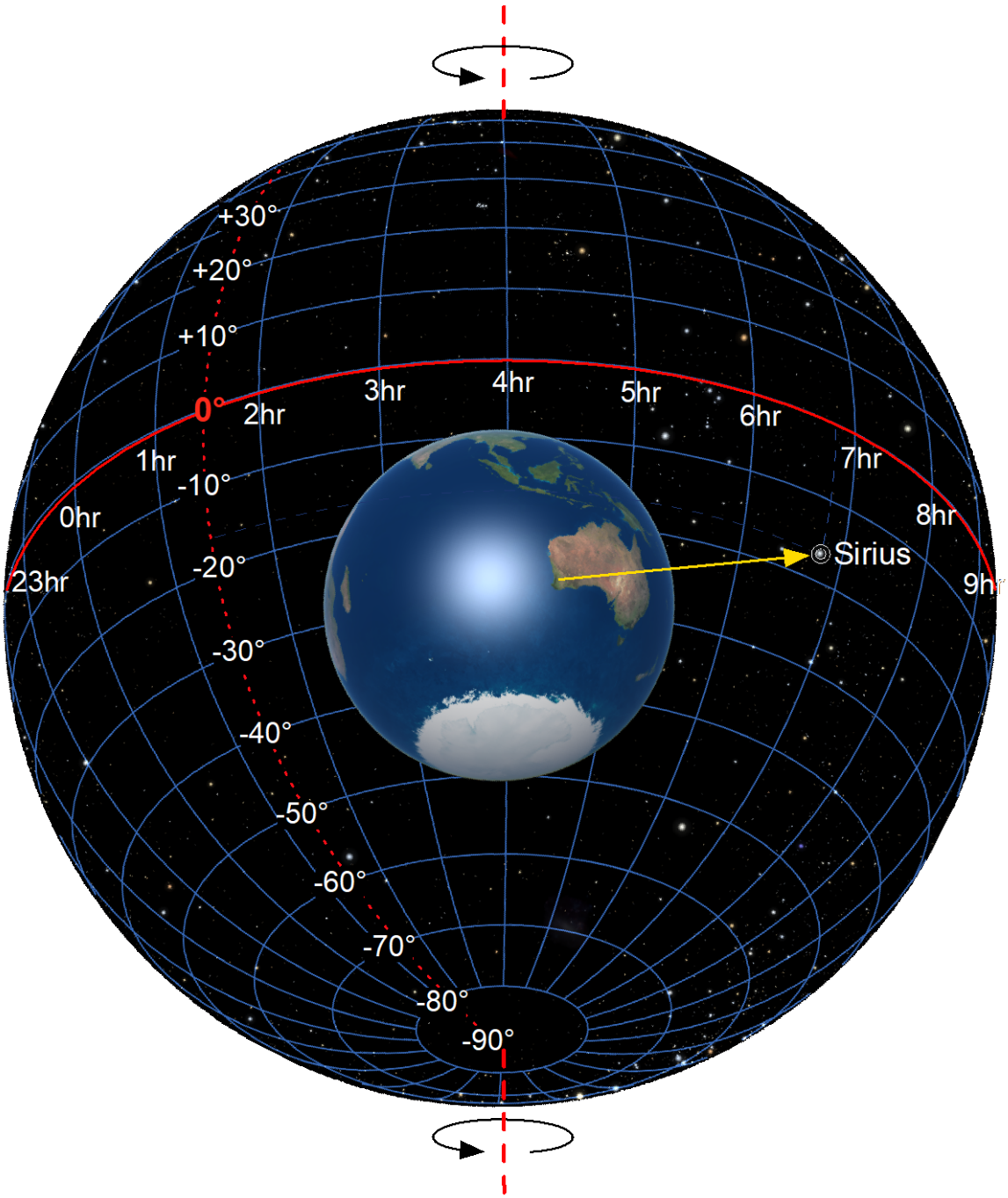
Right ascension specifies the east/west position of an object on the celestial sphere and is measured in hours. 24 lines of RA run from north to south around the celestial sphere starting from 0 hour and increasing eastwards.

Declination is similar to latitude. It positions an object north or south on the celestial sphere. Declination ranges from +90° at the north celestial pole to -90° in the south (southern declinations are designated using negative values). The celestial equator sits at 0° declination.

The skies above Perth occupy southern declinations. It is not possible to view astronomical objects that have declinations of +58° or greater as they are below Perth's northern horizon. In order to observe objects in the far northern sky you must travel to the northern hemisphere.

An astronomical object can be positioned and visualised on the celestial sphere using its coordinates.

For example, the star Sirius has coordinates: RA: 6hr 45m 8.3s DEC: -16° 43’ 15.9” and is easily visible from Perth’s latitude.



While the celestial sphere provides a good way to visualise the position of the Earth in space, it is more convenient to view the sky as it appears looking *up* from the Earth. Planetarium programs such as *Stellarium* provide this capability, together with the means to display an equatorial grid with lines of RA and DEC.

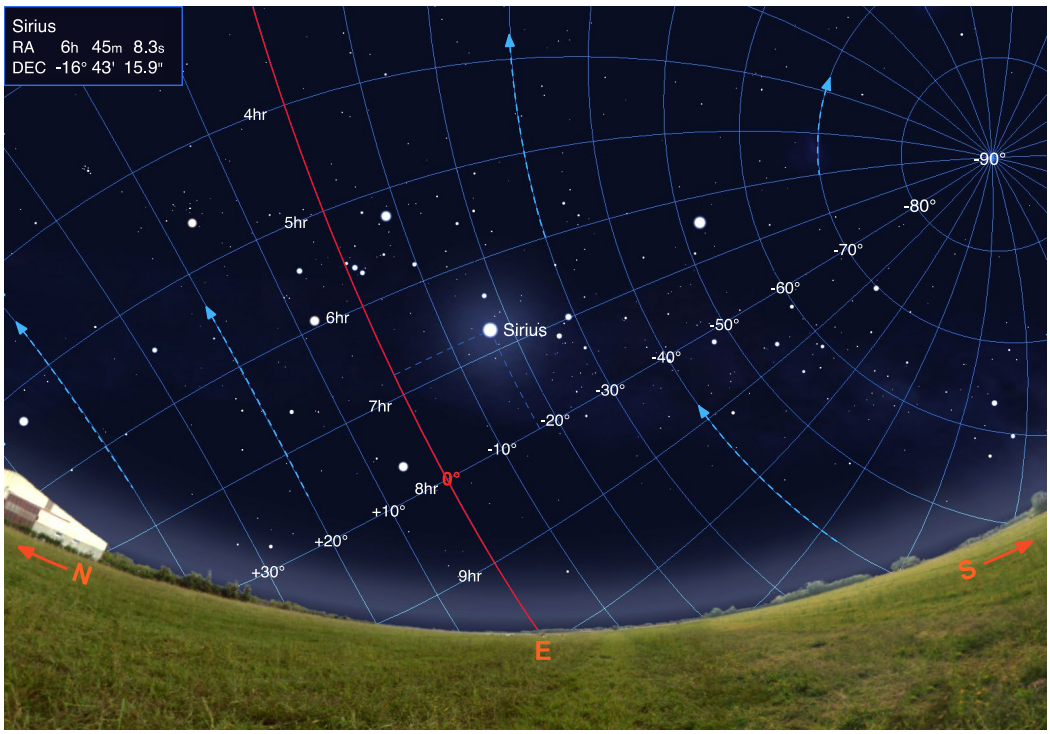


Figure 3: The equatorial grid in *Stellarium* showing lines of RA and DEC, and the star Sirius looking east in early January

As seen from Perth, the equatorial grid rotates from east to west around a point in the sky at the south celestial pole (-90° declination).

Epochs

Although they appear fixed, celestial coordinates of stars and other astronomical objects change very slowly over time. The movement of targets from their current position is caused by a number of factors, including precession—a wobble of the Earth's axis over a 26,000 year period.

Astronomers use the concept of an epoch to help standardise coordinate use in astronomy. In planetarium programs such as *Stellarium,* object coordinates may be listed as both epoch "J2000" and epoch "current date". J2000 refers to the object's position at the beginning of the year 2000, and is the standard currently used by astronomers when working with coordinates. 'Current date' specifies the position of an object at the precise moment in time specified in *Stellarium* and represents the true position of the object on the celestial sphere.

Though the difference between J2000 and 'current date' coordinates is often very small, J2000 coordinates should be used when targeting with *SPIRIT*.