

### Patterns in the Sky (cont)

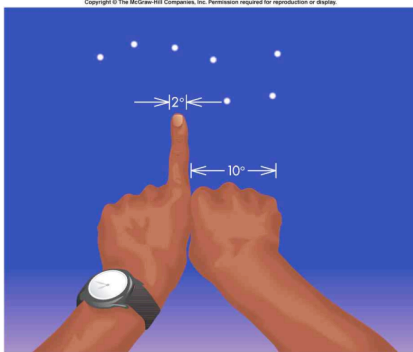


What motions do we see in the sky, and how can we explain them?

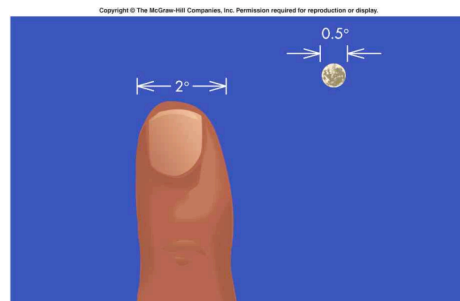
### What do we mean by “Patterns in the Sky”

- Grouping of celestial objects (Sun, Moon, planets, groups of stars) that we see in the sky
- How do we describe those in terms of numbers (“the Greek obsession with geometry”)
- What are the cyclical recurrences of these phenomena?
- How do we explain these in terms of a modern understanding of the solar system?
- See Chapter 2 of book (later 3 and 4)
- Let’s begin with the numbers we use to describe the locations of objects in the sky (“angles on angles”).

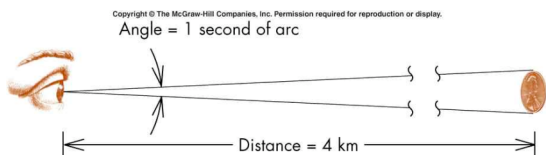
### Angular measure (degrees)



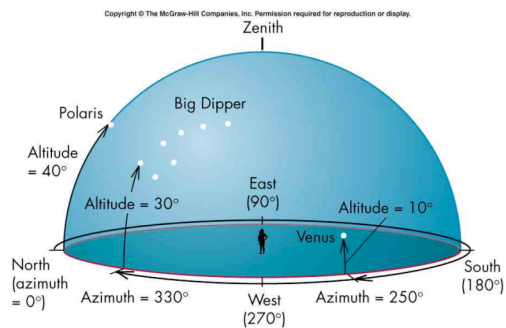
### Angular measure (degrees)



### Smaller units of angular measure...arcseconds



### Coordinate systems in astronomy...the Horizon System

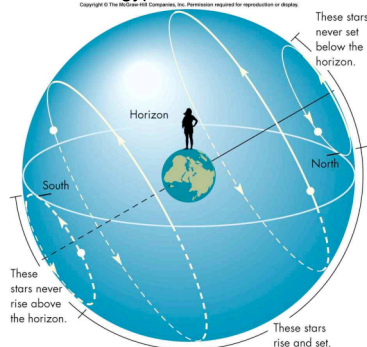


### Important terms in describing the position of objects in the sky

- Celestial sphere
- Zenith (a location on the sky)
- Horizon
- Meridian
- Altitude angle
- Azimuth angle

### The Circumpolar Stars... "The Immortals" to the ancient Egyptians

We see the Sun, Moon, planets, and stars rise in the east, transit the meridian, and set in the west





demonstration

### Question:

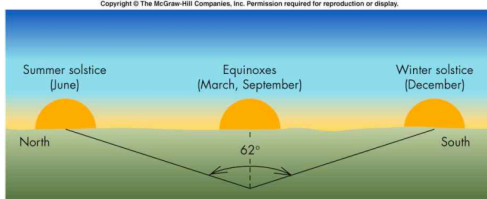
To our eyes, it looks like the celestial sphere is turning on an axis over our heads. What is really going on?

### Fundamental astronomical observation:



The path of the Sun across the sky changes from one day to the next. See Figure 2.16 of text

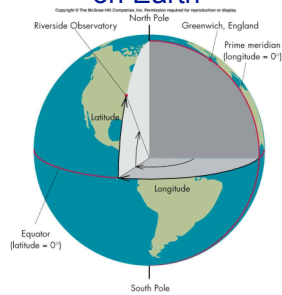
### The changes in the rising (and setting) locations of the Sun are big



### How do we understand these changes during the year?

- Method 1: introduce a second coordinate system for use on the sky
- Method 2: understand the physics of the solar system (later)
- New coordinate system is like defining your location on Earth (what are the coordinates for locating a position on Earth?)

## Coordinates to determine a location on Earth

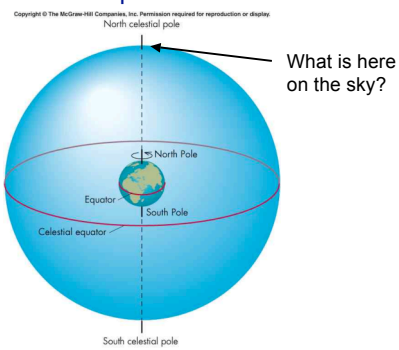


Outside looking at the surface of a sphere

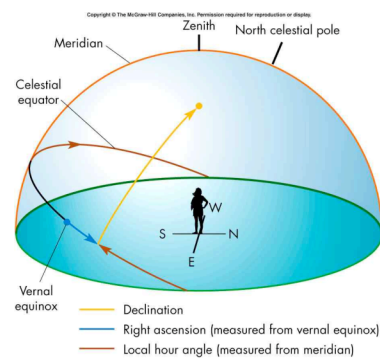
New system: the *equatorial coordinate system*. Coordinates fixed with respect to the stars

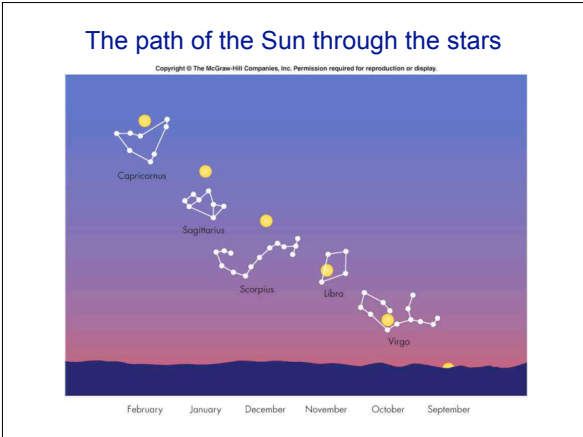
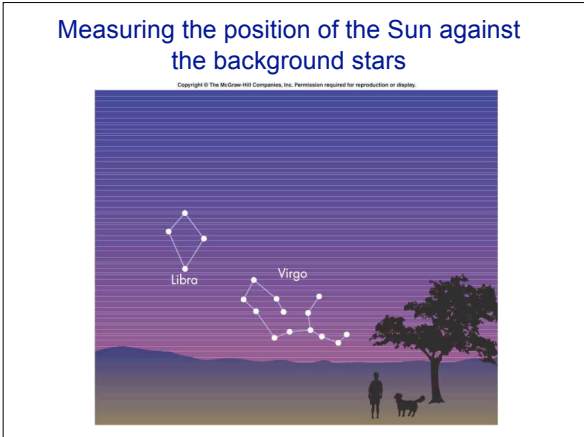
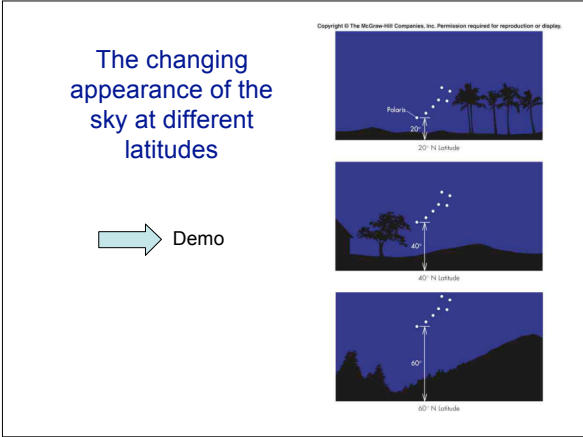
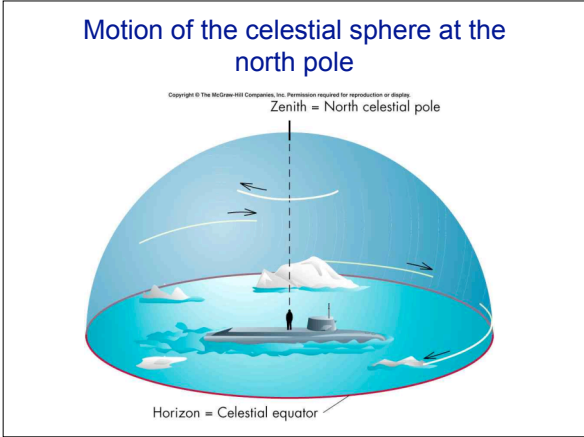
From inside looking out at the surface of a sphere

## The north celestial pole and the celestial equator



## The equatorial coordinate system: right ascension and declination

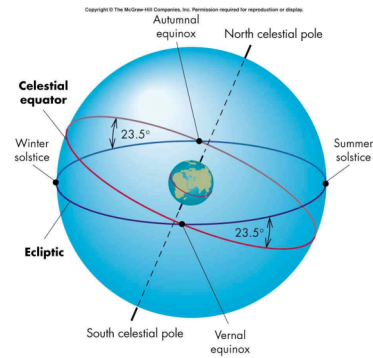




### Another and related astronomical fact:

During the course of the year, the Sun moves against the background stars, just like the planets

### Another great circle on the sky...the ecliptic



### Important terms and concepts in the equatorial coordinate system

- Celestial equator
- North and south celestial pole
- Right ascension (coordinate like longitude, only units are hours, minutes)
- Declination (coordinate like latitude)
- Ecliptic
- Vernal equinox (sometimes called “the first point of Aries”)