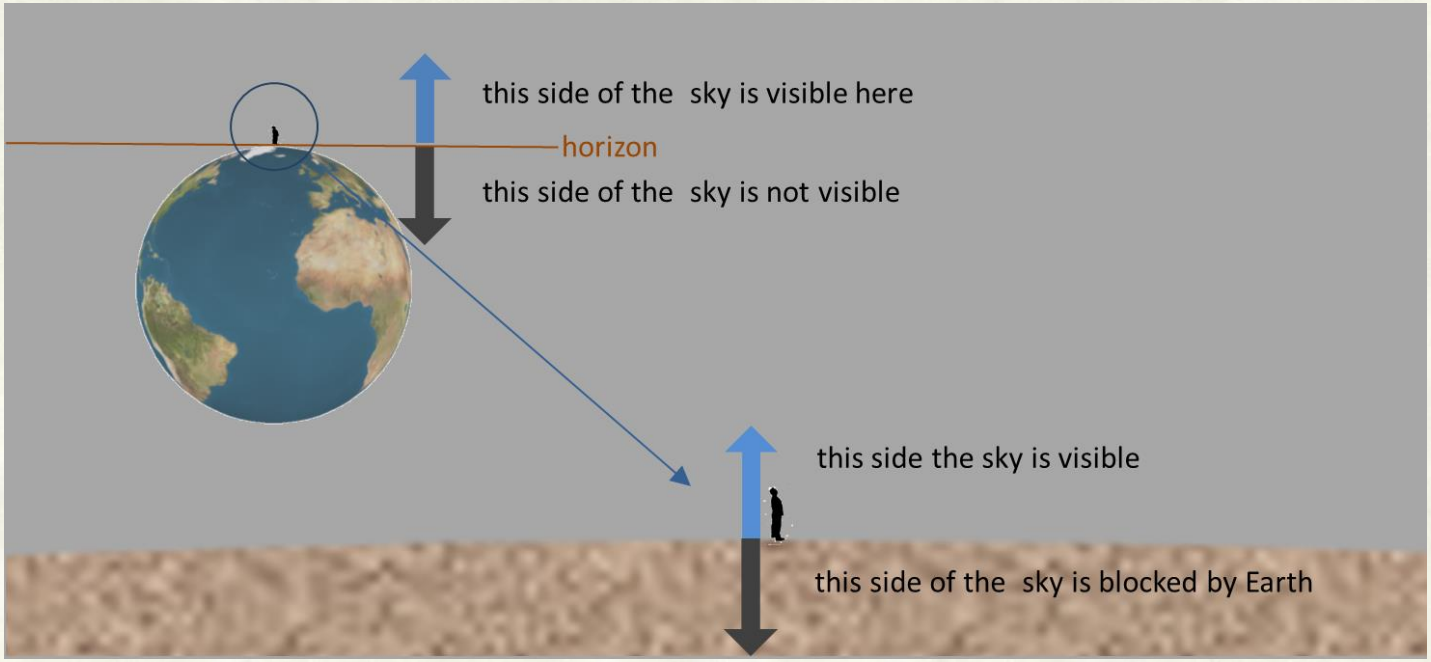
Motions of the Sky
ASTR 101
8/31/2018

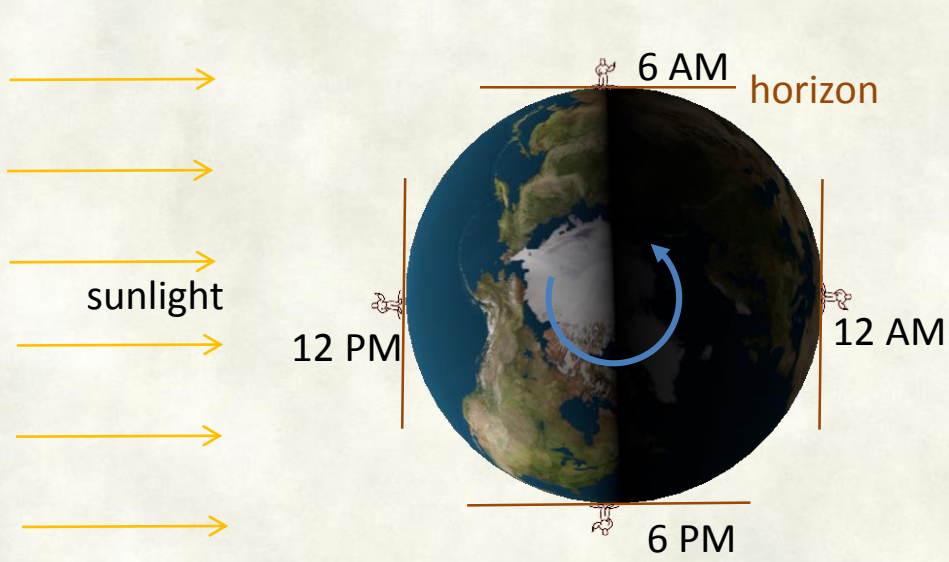
- Daily and annual motion of the sky
- Sky from different locations

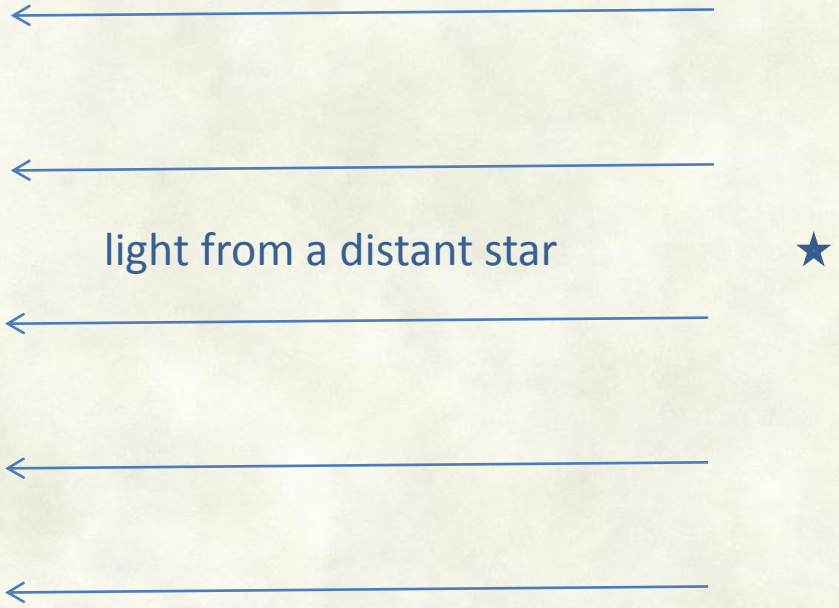
The sky visible from a given location



- Part of the sky visible depends on:
  - The time of the day
  - The day of the year.
  - The location (latitude)

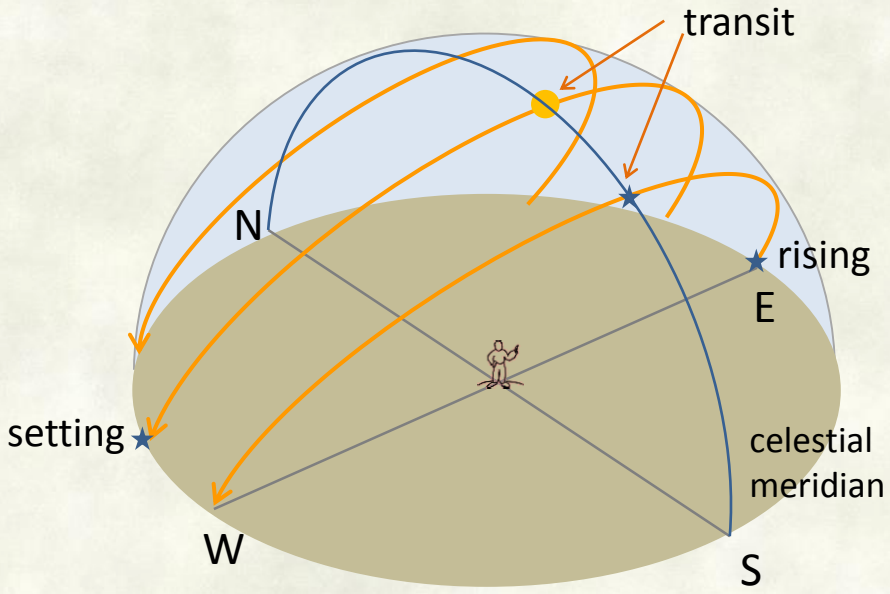
Daily Motion of the Sky





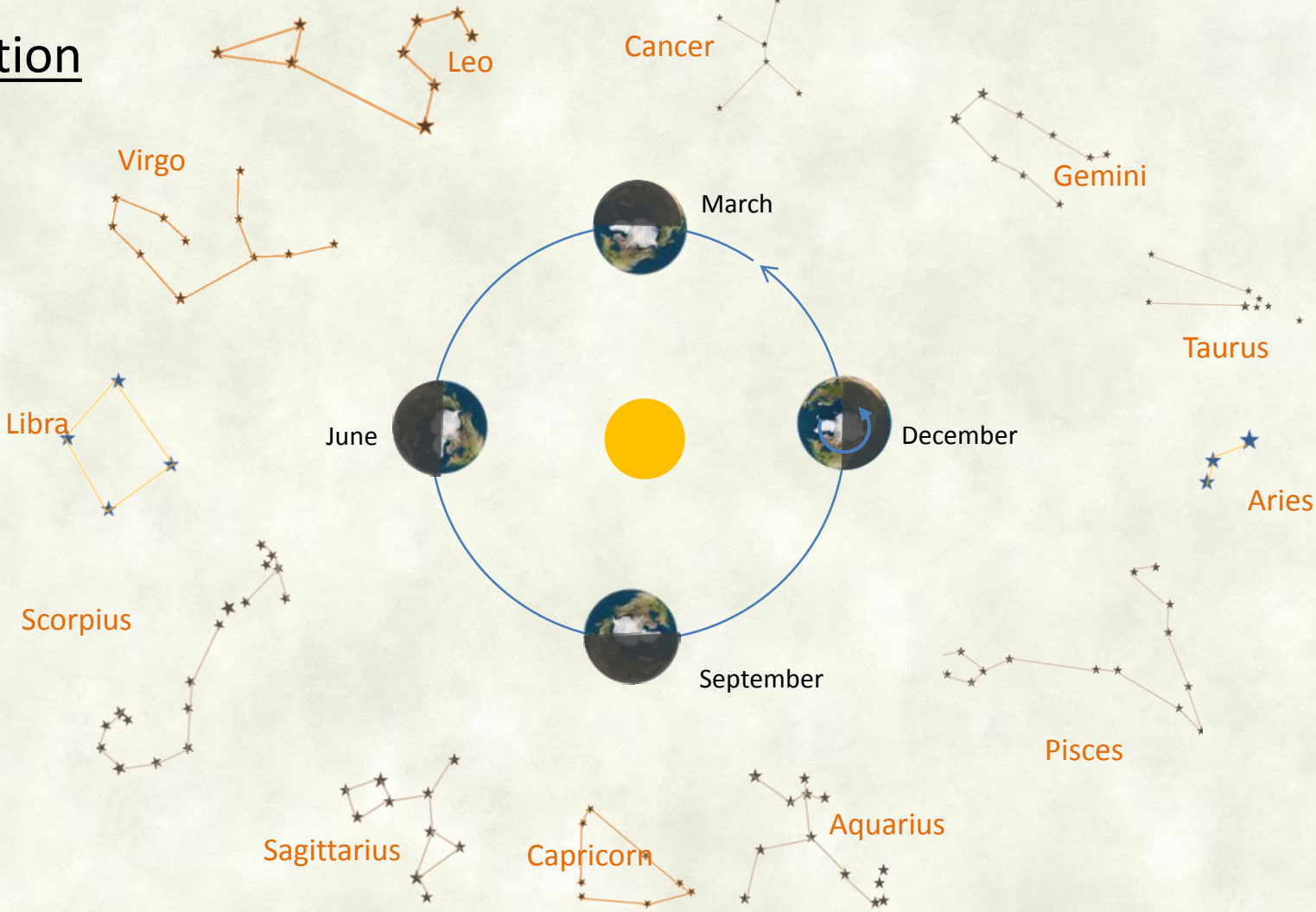
- The side of the Earth facing sun is in daylight, the other side facing away is in night.
- All celestial objects rises in the East, travels across the sky and sets in the West.
- This apparent motion is due to the rotation of the Earth.
  - As the Earth rotates an observer faces different directions of the sky

Daily Motion of the Sky

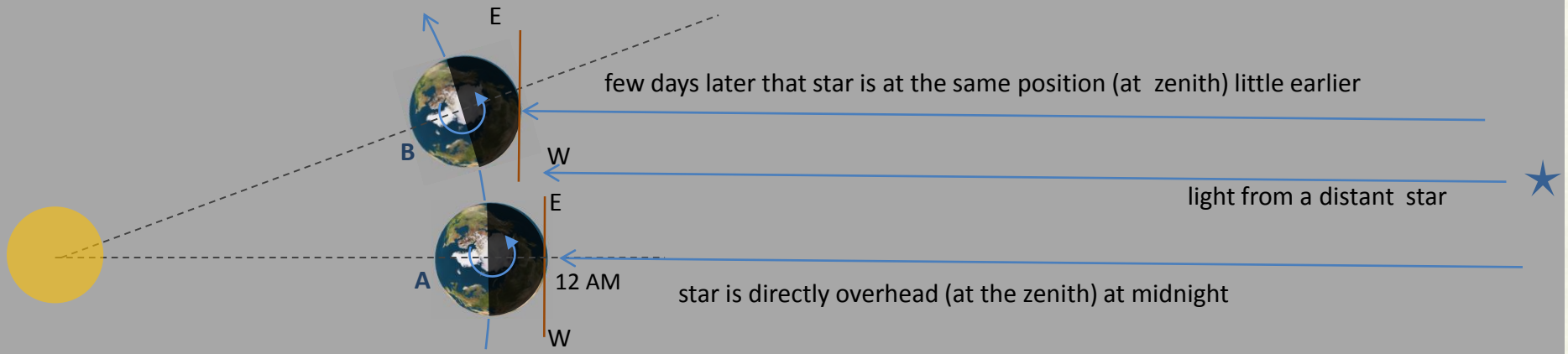


- All celestial objects appears to rise in the East, moves across the sky and sets in the West.
- They have the highest elevation above horizon (altitude) when crossing the meridian (also called **transit**)

Annual Motion

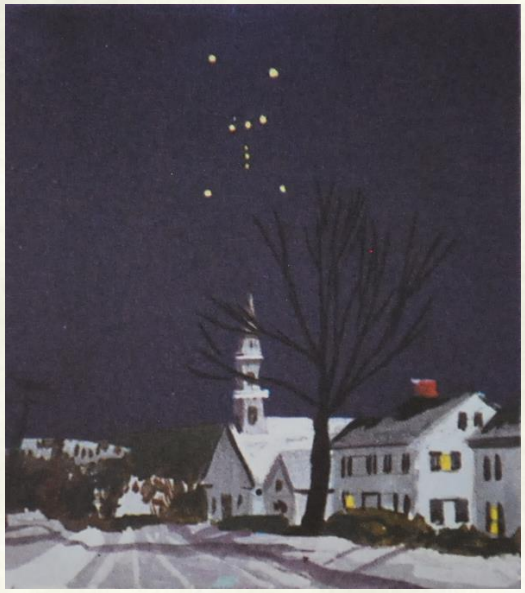


- Region of sky visible is also depends on the day of the year ie. position of the Earth on its' orbit.
  - As the Earth goes around the sun, night side of the Earth faces different directions in the sky.
  - So different stars are visible in the sky at different times of the year.



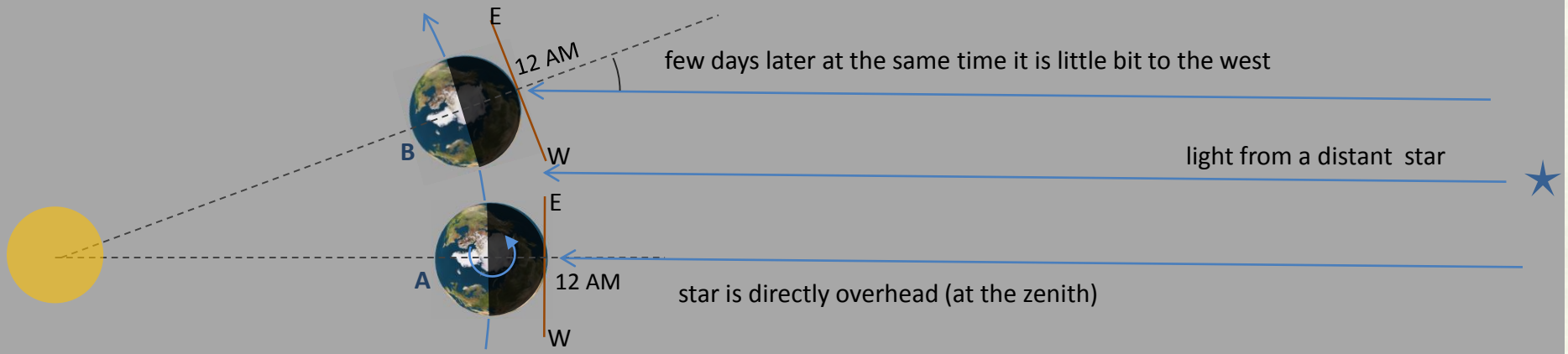
- A star comes to a same position in the sky 4 minutes earlier than the pervious day.

Orion in the winter sky



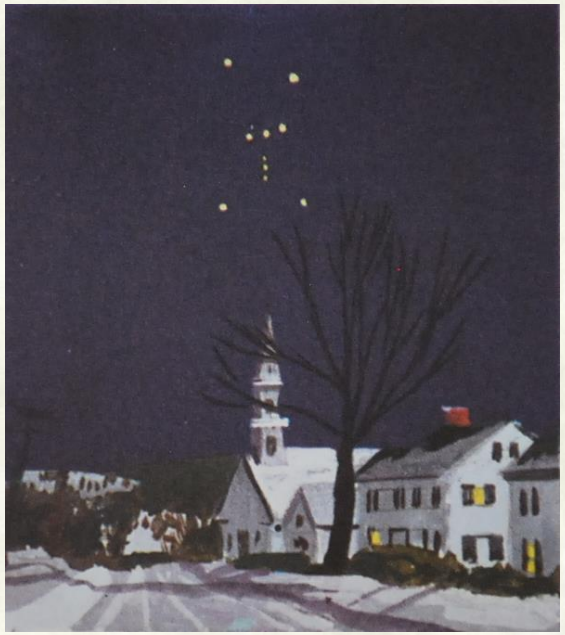
same time two weeks later

same time four weeks later



- A star comes to a same position in the sky 4 minutes earlier than the pervious day.
- At the same time and location, we see the same star about 1^0 westward than the previous day.

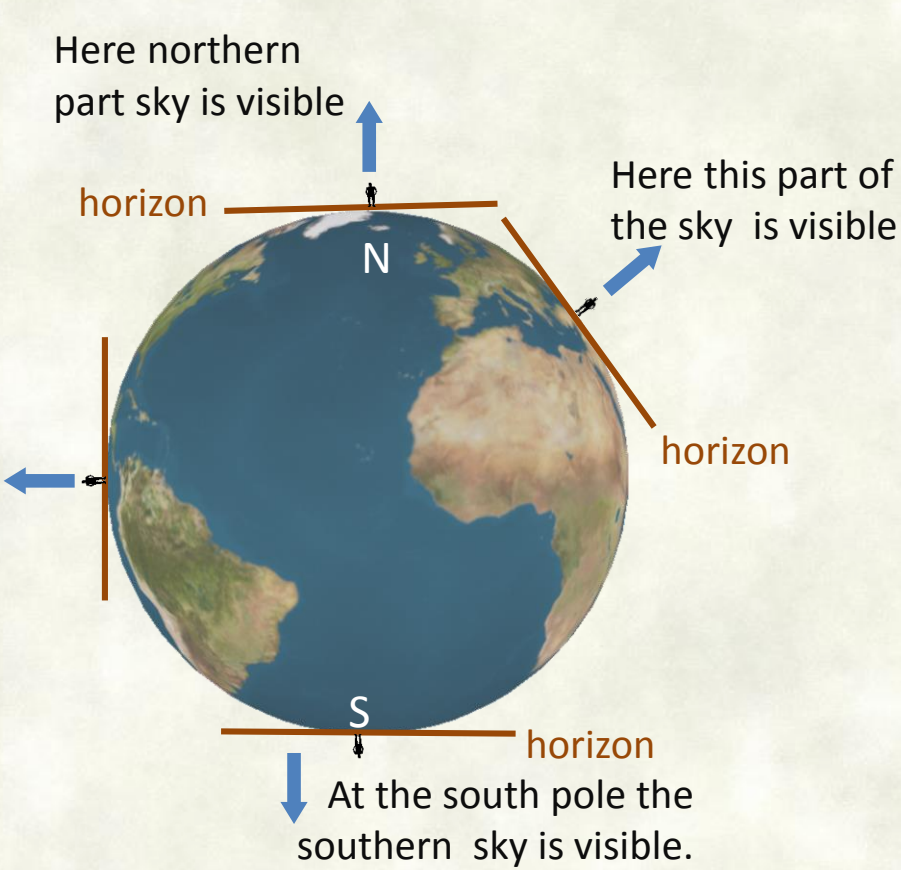
Orion in the winter sky

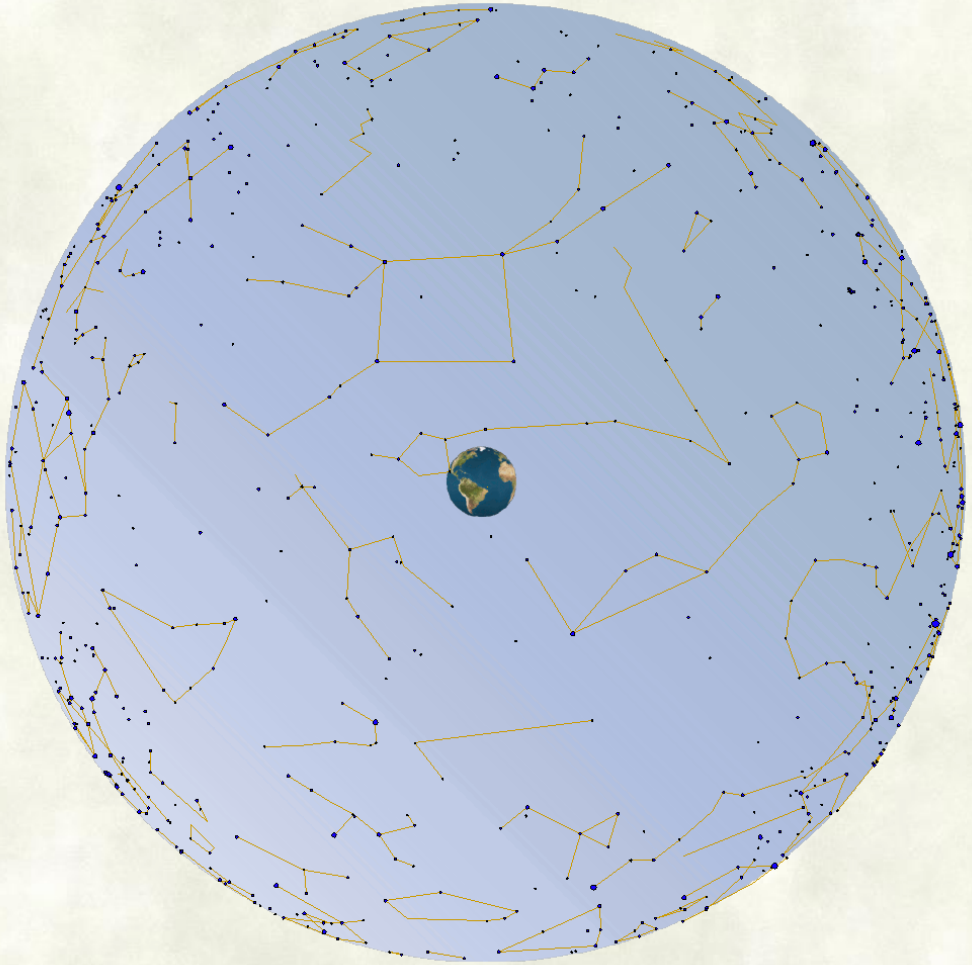


same time two weeks later

same time four weeks later

The sky visible at different locations

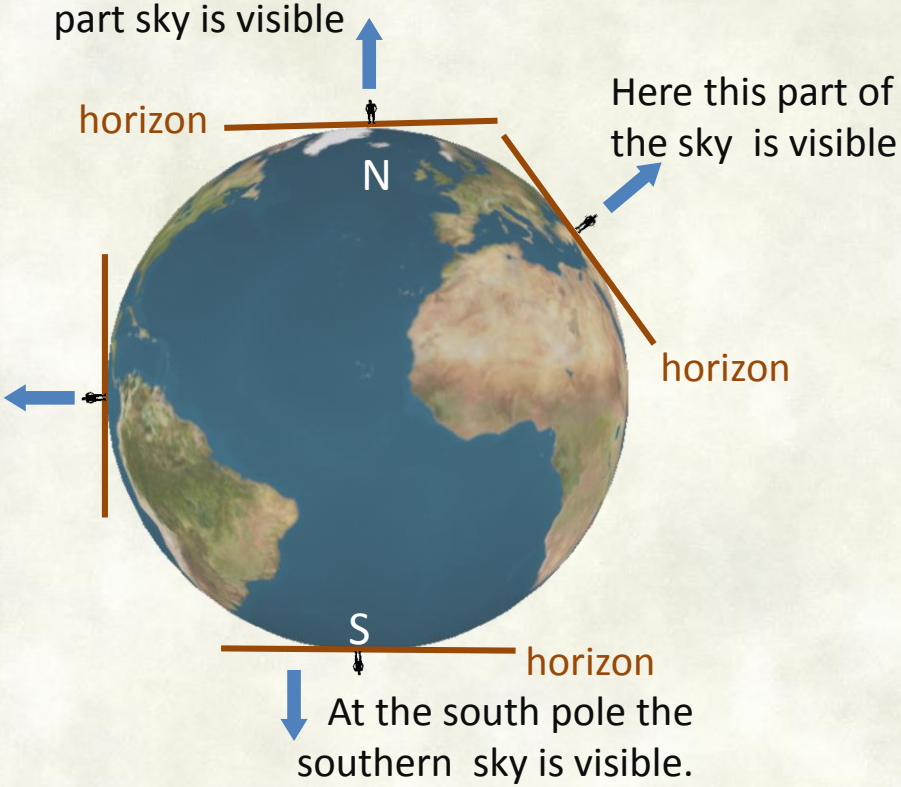


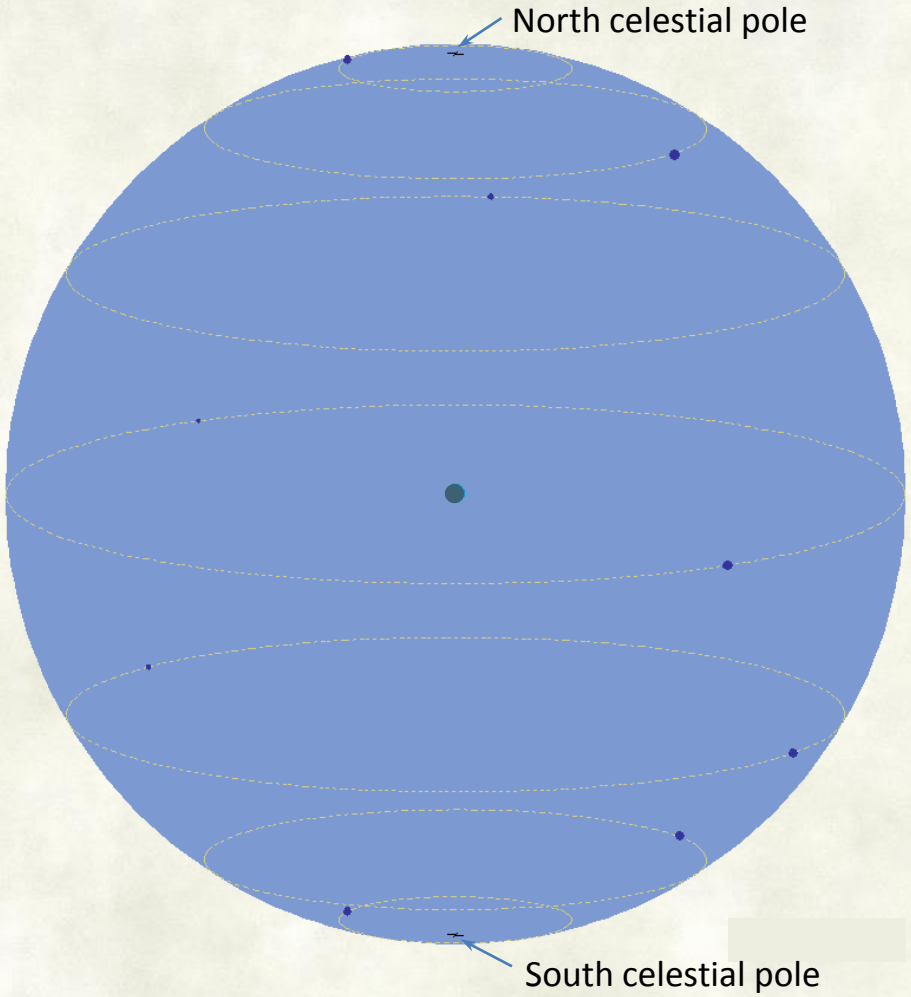


www.phy.olemiss.edu/~perera/animations/celes_sp.gif

- At a given time and location we see half of the sky, the sky above the horizon at that location.

The sky visible at different locations

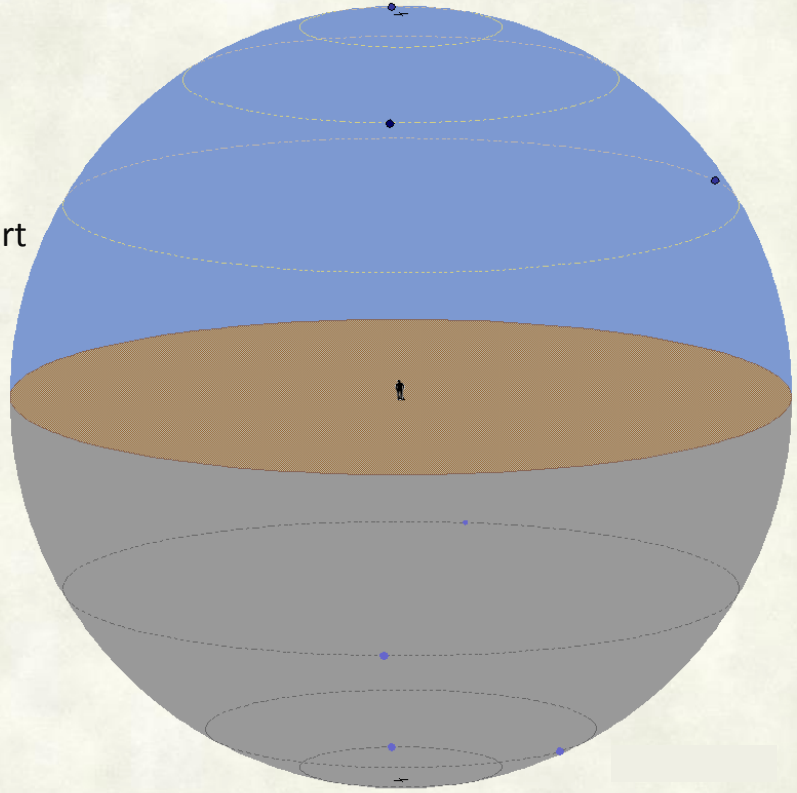


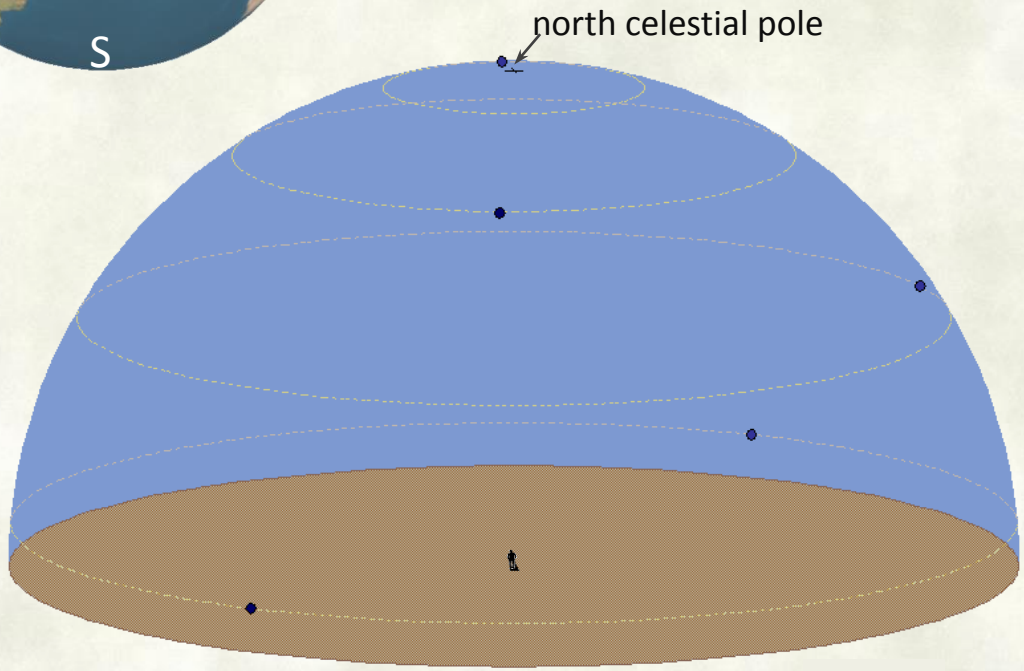


For simplicity consider only a few stars

- Celestial sphere (sky) appears to rotate around north-south axis.
- Orientation of the celestial axis w.r.t. horizon depends on the latitude

View of the sky from North Pole.





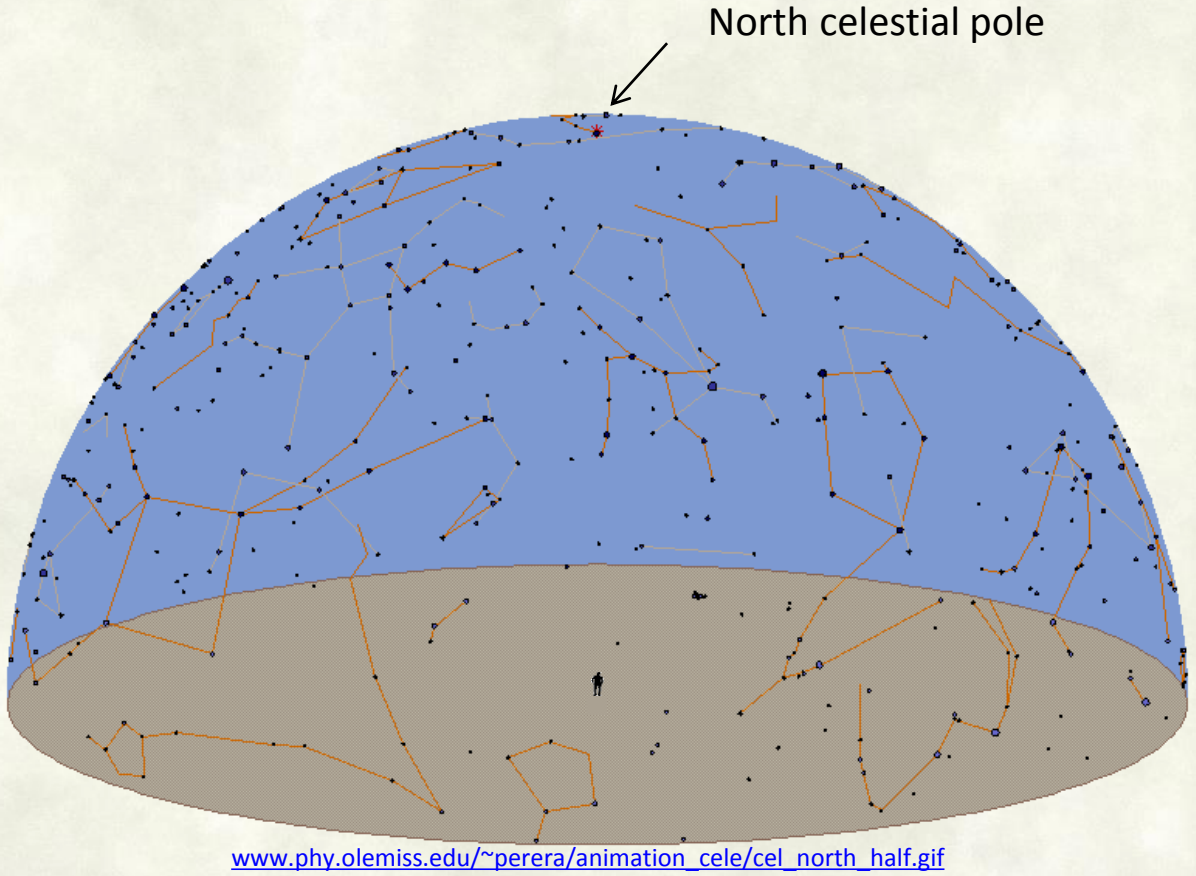
View of the sky from the North pole

(blue: above the horizon;
gray: below horizon)

All objects above horizon always stay above horizon at the same altitude, only their direction change.

www.phy.olemiss.edu/~perera/animations/sky_northp.html

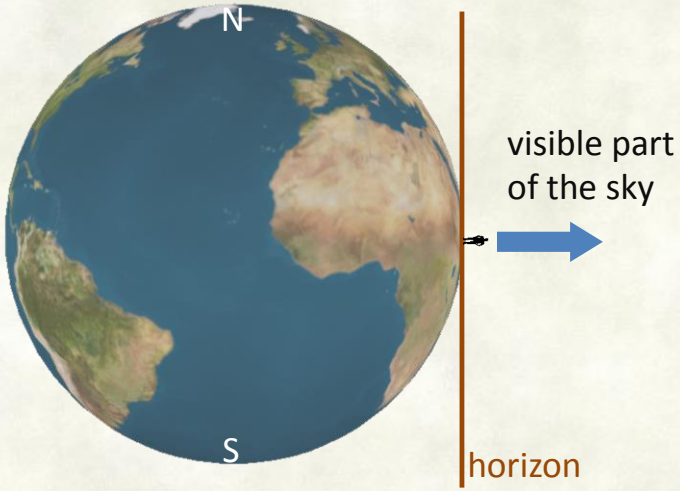
Sky from the North Pole

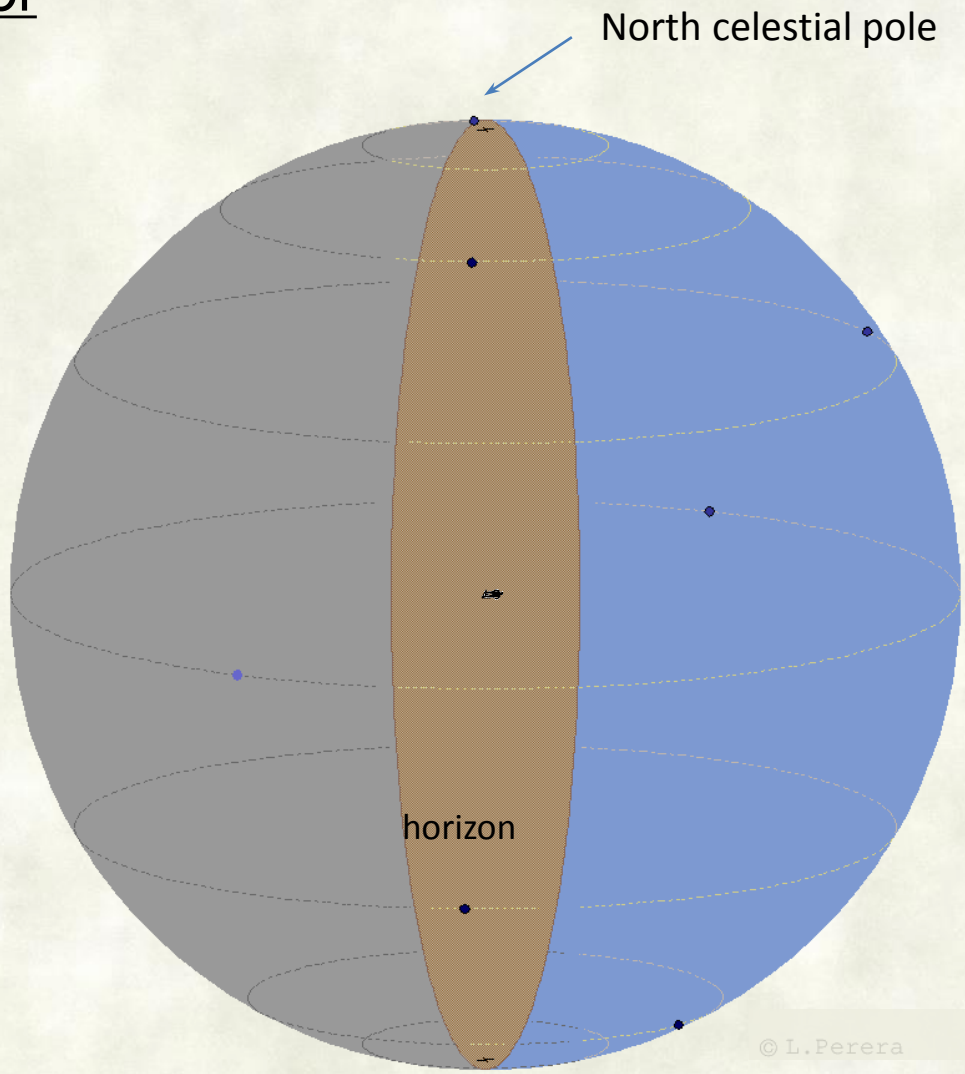


www.phy.olemiss.edu/~perera/animation_cele/cel_north_half.gif

Celestial sphere as seen from the north pole, only the visible side
All objects above horizon always stay above horizon at the same altitude, only their direction change.

View of the sky from the Equator



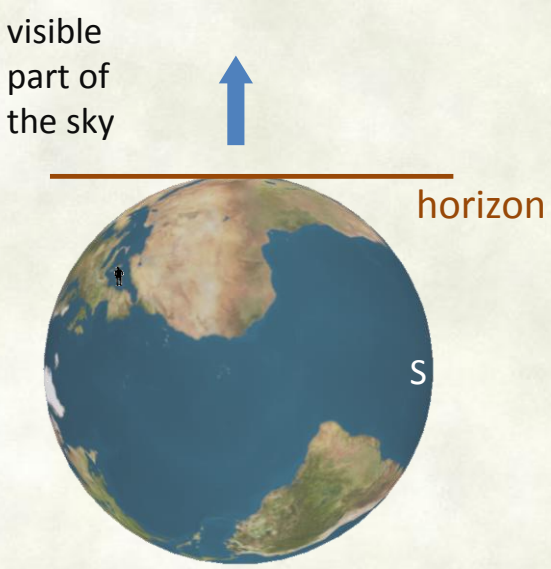


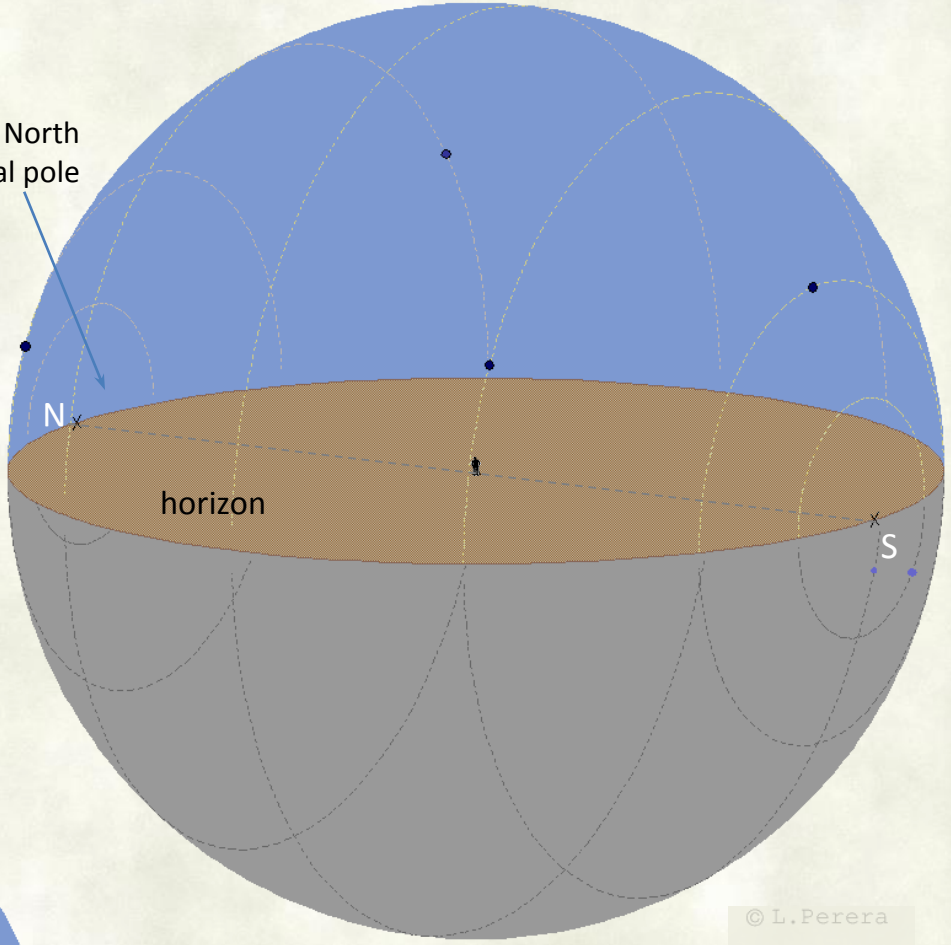
(blue: above the horizon;
gray below horizon)

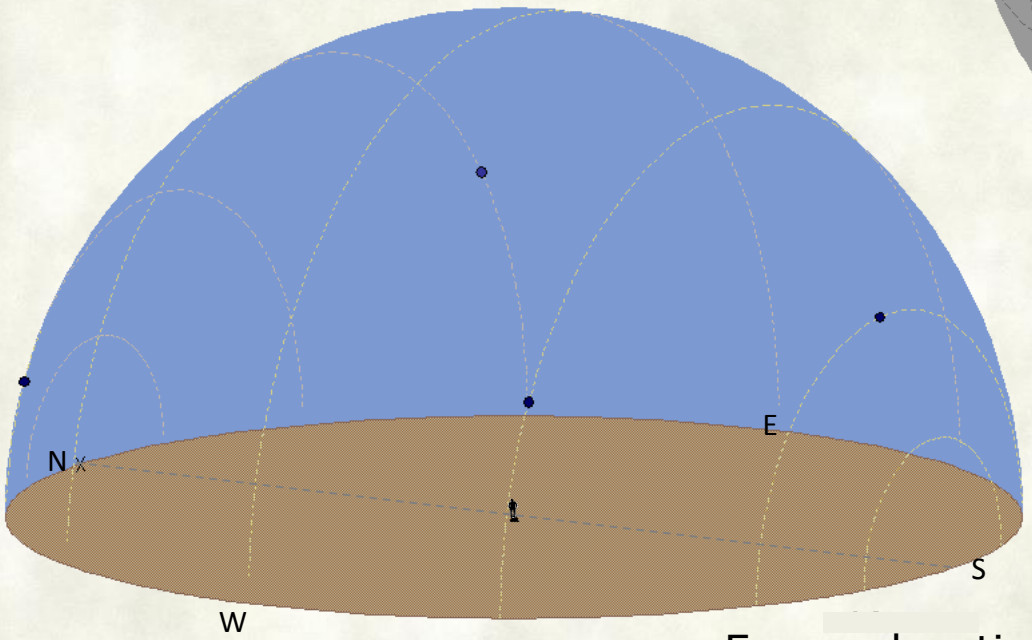
Celestial sphere as seen from a location on the equator,

Celestial sphere (sky) from North pole to South pole is visible.

Stars from the Equator (Same as before, but rotated so that horizon is horizontal)





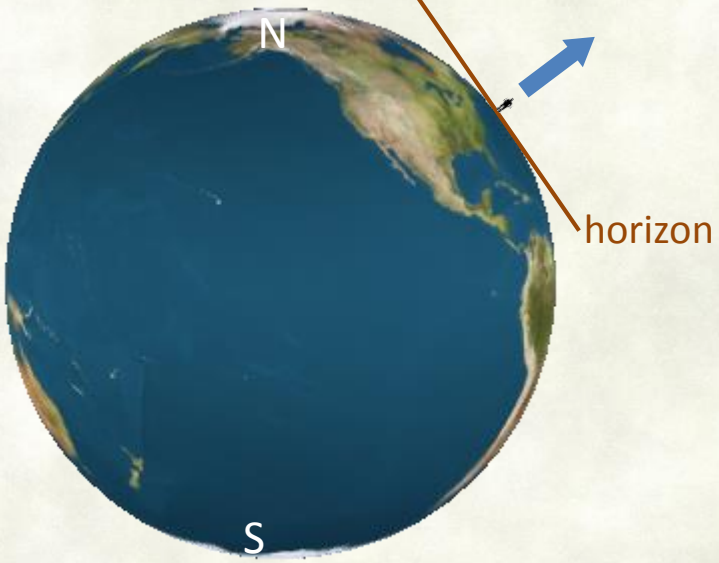


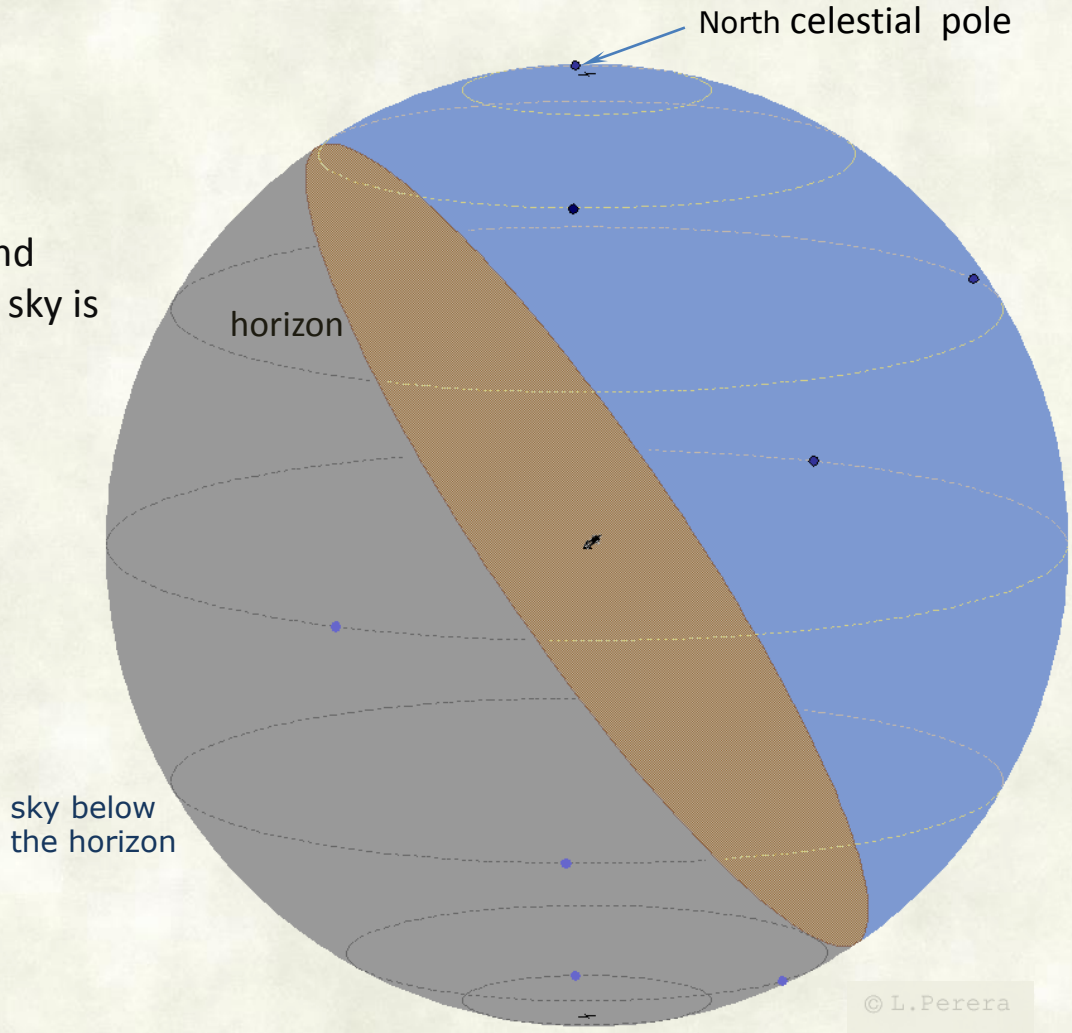
Celestial sphere as seen from a location on the equator, celestial sphere (sky) from North pole to South pole is visible.

From a location on the Equator whole sky can be seen.

Sky from any other location in the northern hemisphere

(e.g. from Oxford, 34°N)





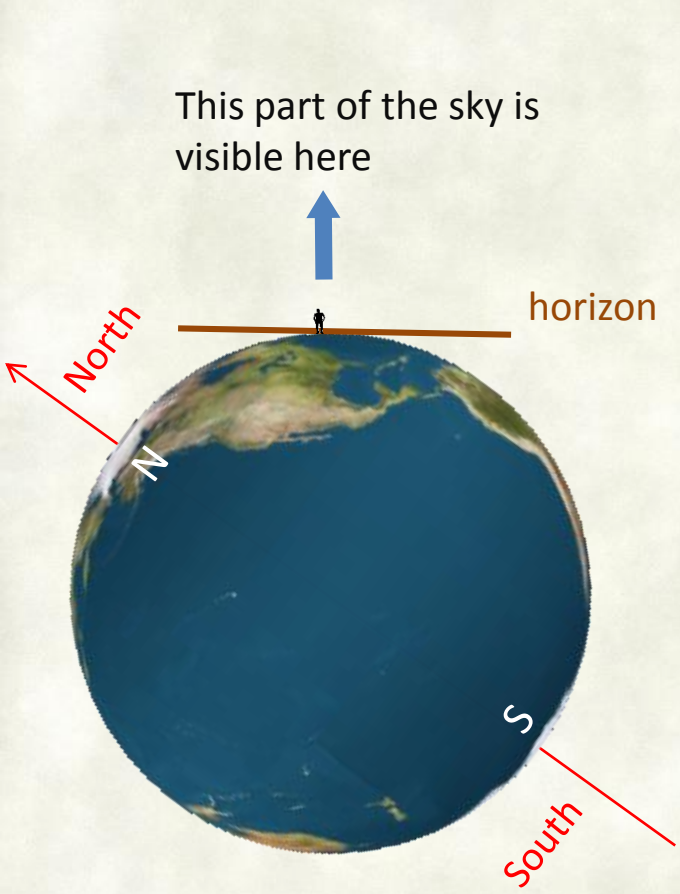
www.phy.olemiss.edu/~perera/animations/sky_oxford.html

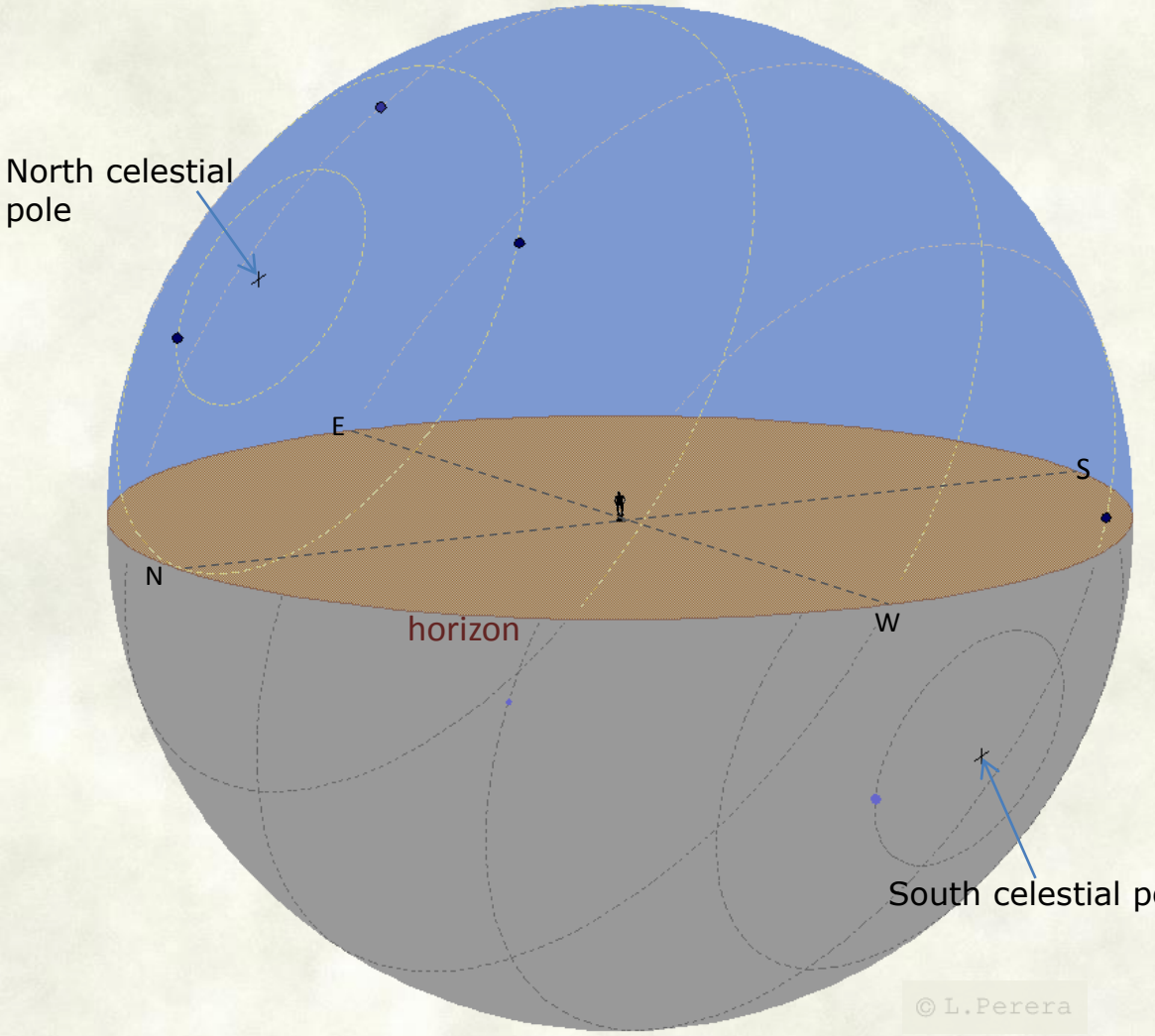
Celestial sphere as seen from a location on the northern hemisphere (34°N)

(cyan: above horizon; gray below horizon)

Sky from a northern latitude (from Oxford)

(Same as before, but rotated so that the horizon is horizontal)



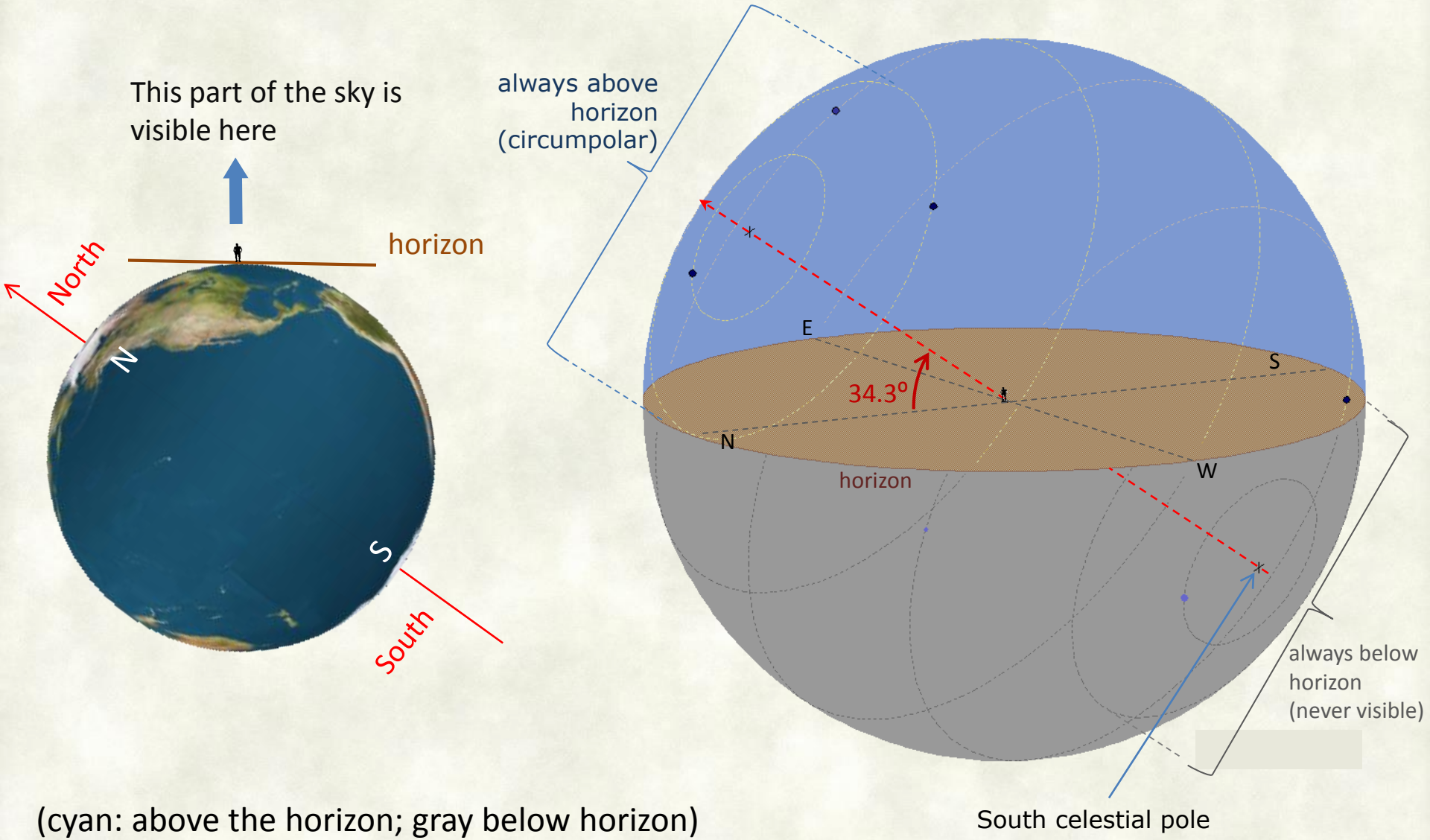


(blue: above the horizon; gray below horizon)

www.phy.olemiss.edu/~perera/animation_cele/cele_ox_rfull_s.gif

Sky from a northern latitude (from Oxford)

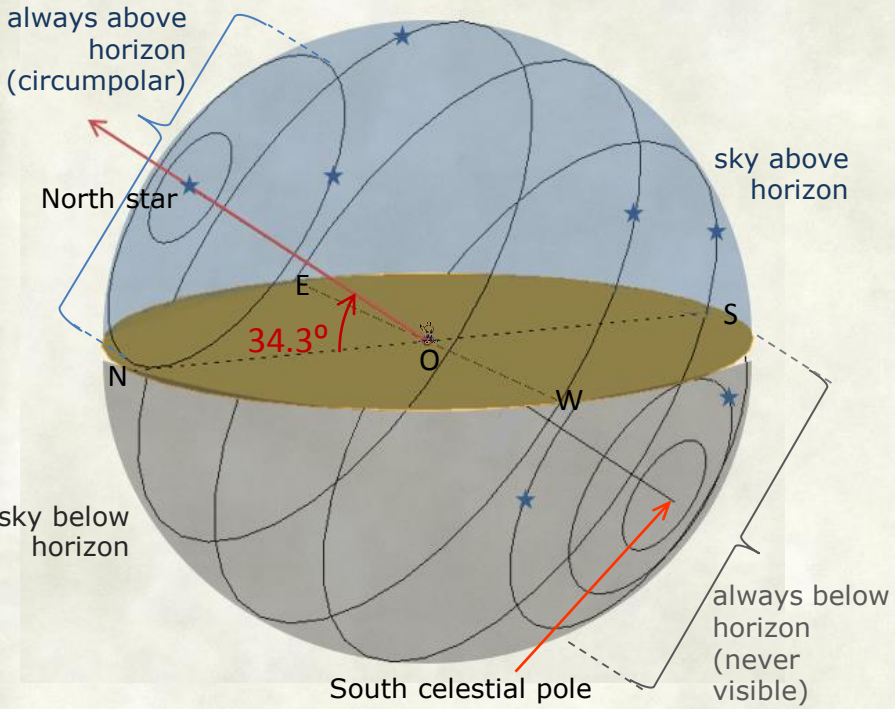
(Same as before, but rotated so that the horizon is horizontal)

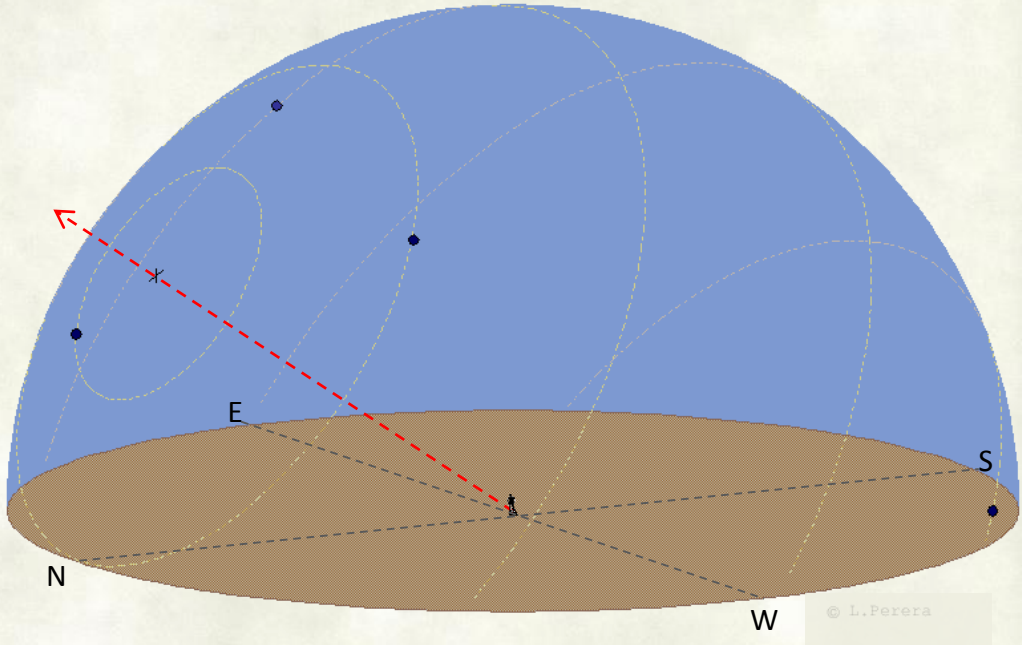


(cyan: above the horizon; gray below horizon)

www.phy.olemiss.edu/~perera/animation_cele/cele_ox_rfull_s.gif

Sky from Oxford, MS

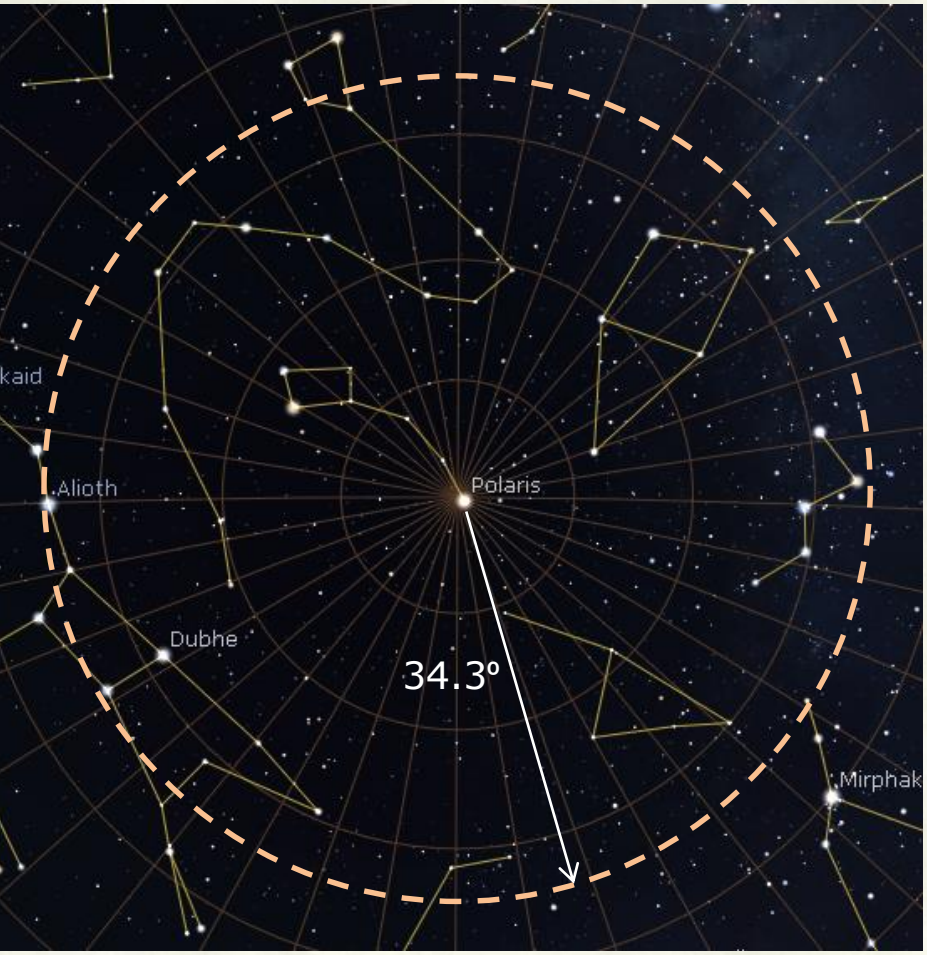




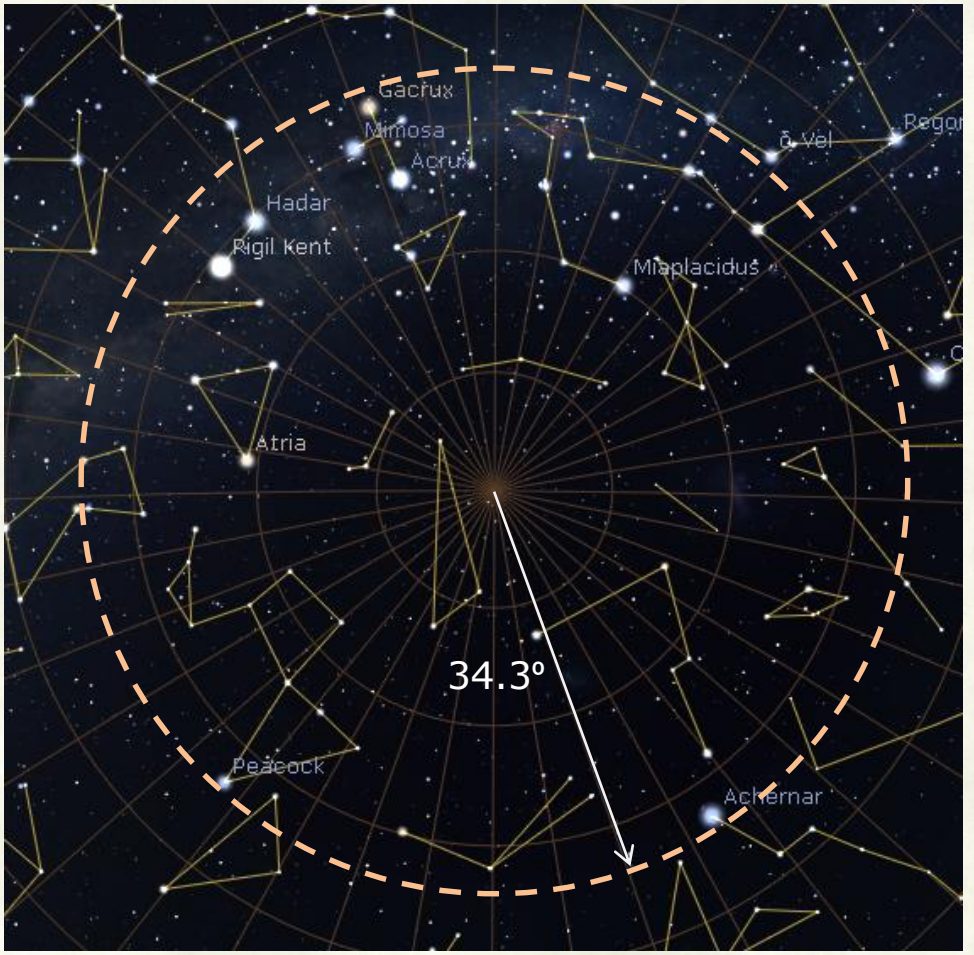
- The latitude at Oxford: 34.3^0N
- Celestial north pole (or the north star) is at an altitude of 34.3^0.
- All stars within 34.3^0 of the north celestial pole are circumpolar (always above horizon).
- Part of the sky within 34.3^0 of the south celestial pole is not visible from Oxford.

  (THE reason why we cannot see Magellanic clouds from Oxford)

Sky from Oxford, MS



Circumpolar region of the sky from Oxford.

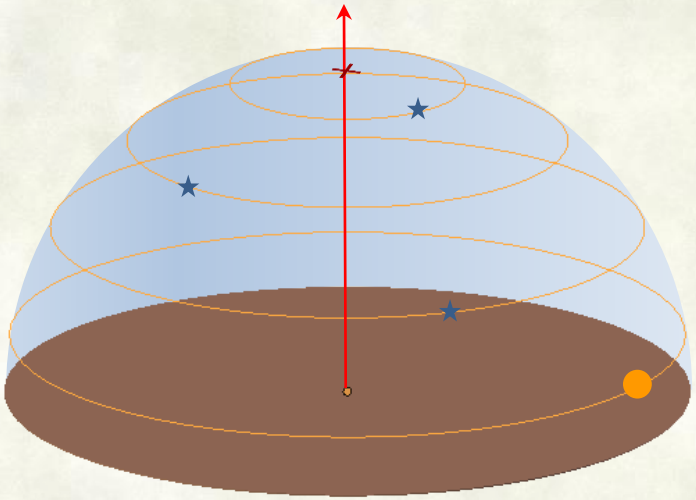


region of the sky not visible from Oxford .

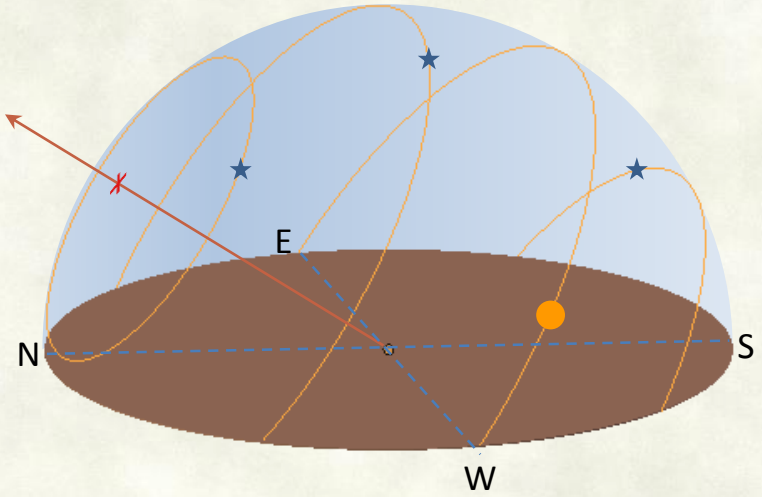
- All stars within 34.3º of the north pole are circumpolar.
- Part of the sky within 34.3º of the south celestial pole are always below the horizon and are not visible.

Daily movement of Celestial objects in the sky

Summary

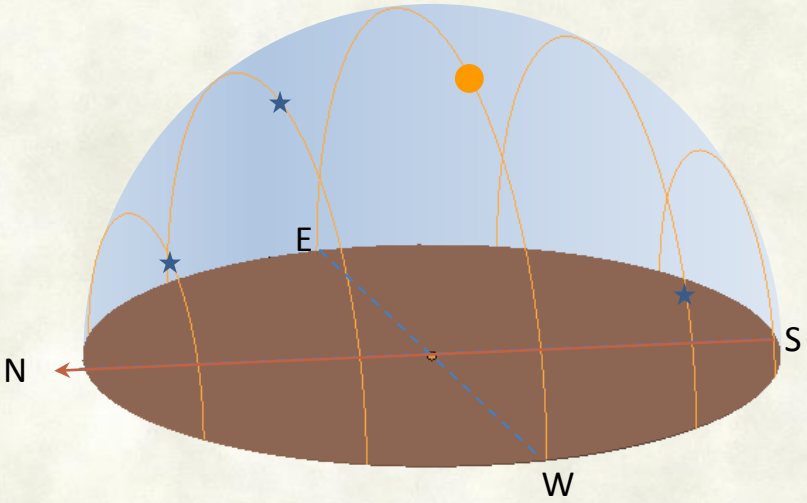


At the North pole



In the Northern hemisphere

- Celestial sphere spins about the North-South (North pole to South pole) axis.
- Altitude of the celestial pole is same as the latitude of the observer.
- From the equator whole sky (north pole to south pole) is visible

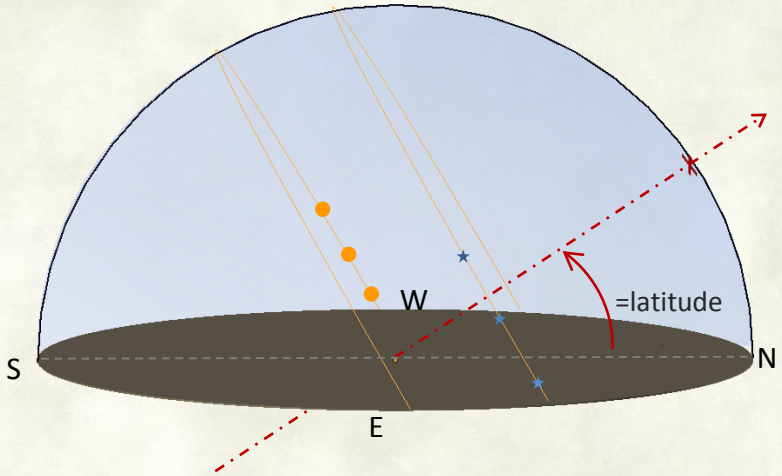


At the Equator

Sunset from Finland (latitude 61°N)

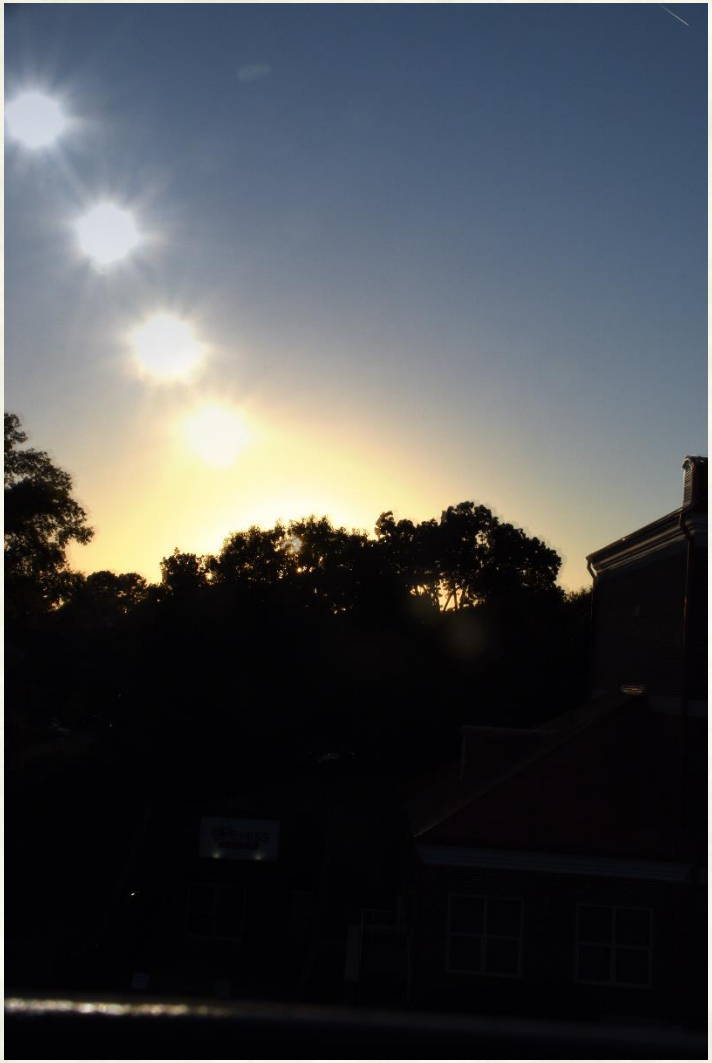
Sunset from Chicago (latitude 42°N)

Sunset from England (52°N)



In the northern hemisphere:

- rising stars/sun head toward the south
- setting stars/sun come from the south



From Oxford on 9/11/2016 (5:40PM to 6:40PM)

Review Questions

- Why aren't the same constellations visible in the evening sky throughout the year?
- You see a certain star directly overhead (at zenith) 8pm today. When do you expect to see it at the zenith tomorrow?
- Why aren't the Magellanic clouds visible from the (continental) US?
- What is the location on Earth you would be able to see the whole sky.
- What would be the view of the night sky from the North pole? What is the apparent motion of stars from the north pole?
- At poles (north or south) Sun is above horizon (day time) for six months and below horizon (night) for the next six months of the year. How would you explain that?
- What are the circumpolar stars? Are there any circumpolar stars visible from Oxford, MS.
- If the altitude of the North star is 30^0, what is the latitude of that location?
- What is the location of the north star in the sky at Oxford MS?
- In the northern hemisphere you see stars are rotating around the north star (north celestial pole) in the counter clockwise direction. What would you see in the southern hemisphere?
- Rising stars head toward the south in the northern hemisphere. What would you expect to see in the southern hemisphere?