

The daily motion of the sky

Astronomy 101
Syracuse University, Fall 2022
Walter Freeman

September 6, 2022

Some announcements

- People just now joining the class: everything you need is on the course website, walterfreeman.github.io/ast101/
 - I think I've fixed the problems with github, so expect faster/more frequent updates
- Labs start this week
 - Today is the last day to change your lab section
 - Most sections are full; we have no ability to override section caps
 - Please contact phyacademics@syr.edu for registration questions/issues
- Homework due Thursday
 - We won't collect it
 - We'll have a "homework quiz" at the end of class
- If you have a Monday lab, you'll do Lab 1 next week

Welcome survey

Thanks to all who filled out the welcome survey!

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- Lots and lots of variants of excitement!

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- Black holes :)

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- By email or over Discord: most of you have cellphone cameras...

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If you're not sure about the reasoning involved, *ask us in class* or on Discord or email. We won't tell you the answers but we'll make sure you know how to get there on your own! (That's the point...)

We *will* almost always have time for you to ask some questions about the homework before the homework quiz.

This week we will...

Today: consequences of the Earth's **rotation**:

- Review the celestial-sphere model from last time
- Complete the first tutorial-exercise that we started last time

Thursday: consequences of the Earth's **revolution**:

- What about the Sun?
- What causes the seasons?
- What does the Sun do to the Earth?
- What are these “Aries”, “Gemini”, “Capricornus”, and “Scorpius” things?
- What is astrology (and what is it *really*?)

The celestial sphere model: summary

- We can pretend that everything on the sky is attached to a sphere that rotates around us.
- The axis of the sphere runs from the North Celestial Pole to the South Celestial Pole.
- This is the same as the rotation axis of the Earth:
 - The NCP and North Star are above the North Pole
 - The SCP and South Star (if there was one) would be “below“ the South Pole
- The sphere rotates counterclockwise, while looking from Earth up at the NCP

Which are true in Syracuse?

- I: Some stars are always visible (at night)
- II: Some stars are only visible sometimes; they rise and set during the night
- III: Some stars are never visible

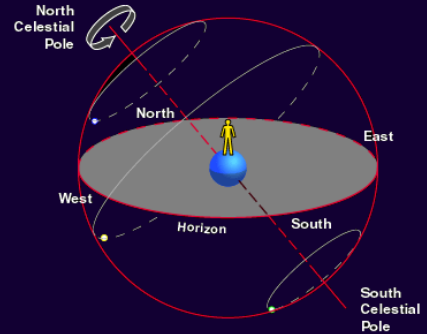
A: I only

B: II only

C: III only

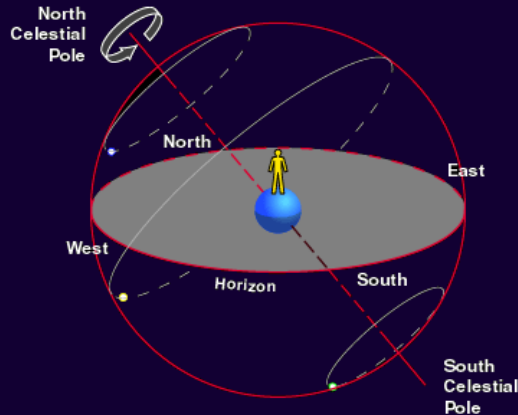
D: I and II

E: I, II, and III

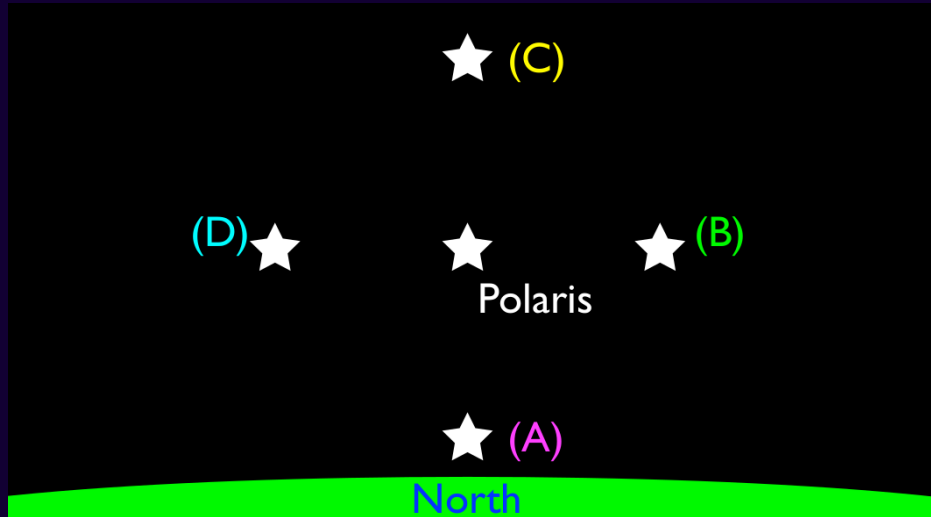


Summary

- We can treat the stars as all rotating together, on an invisible sphere far away
- The axis of rotation is the same as the Earth's, and it rotates once per day
- Only half of the sphere is visible, because the Earth is in the way

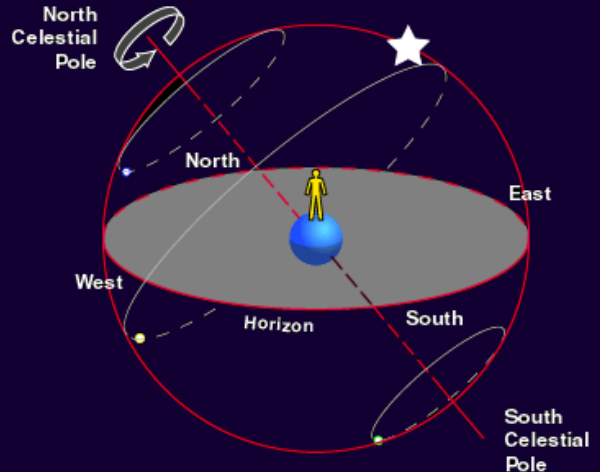


In Syracuse, you see this star at (A). Where will it be six hours later?



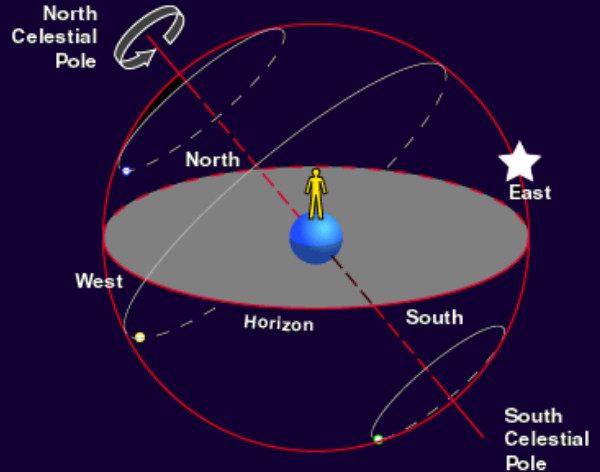
How long is this star visible in the sky each day?

- A: All the time
B: More than 12 hours
C: Less than 12 hours
D: It's never visible



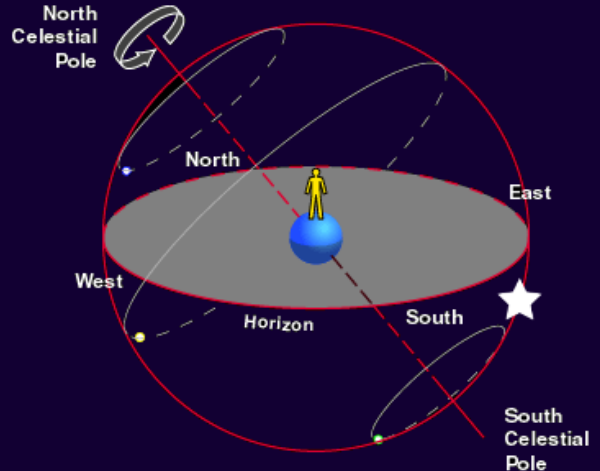
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Tutorial from before

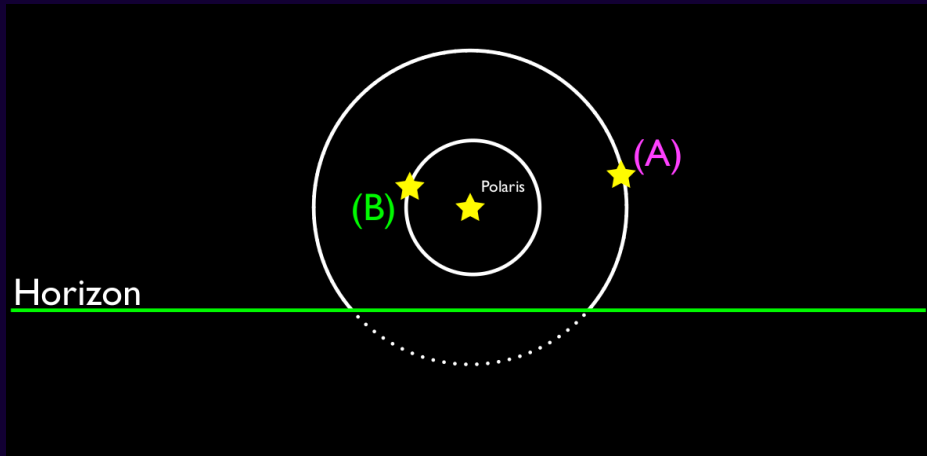
Take 20-30 minutes to complete the exercise from before.

Note: If you have not already done so, change the diagrams on all your handouts so that East is on top and West is on the bottom.

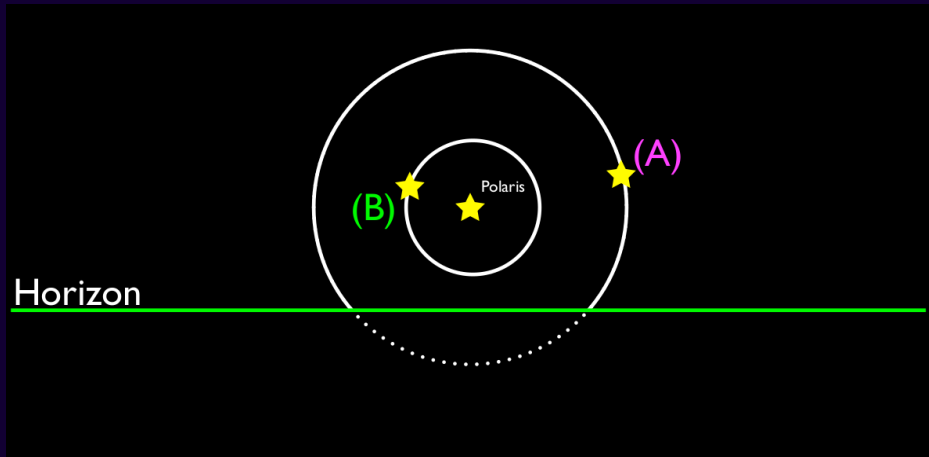
See our discussion for why!

Make sure you talk to the people around you as you work! Raise your hand if you have questions and we'll come chat.

Which star is visible longer?



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We call a star that is always above the horizon **circumpolar**.

Where in the sky should I look to find circumpolar stars?

A: High in the southern sky

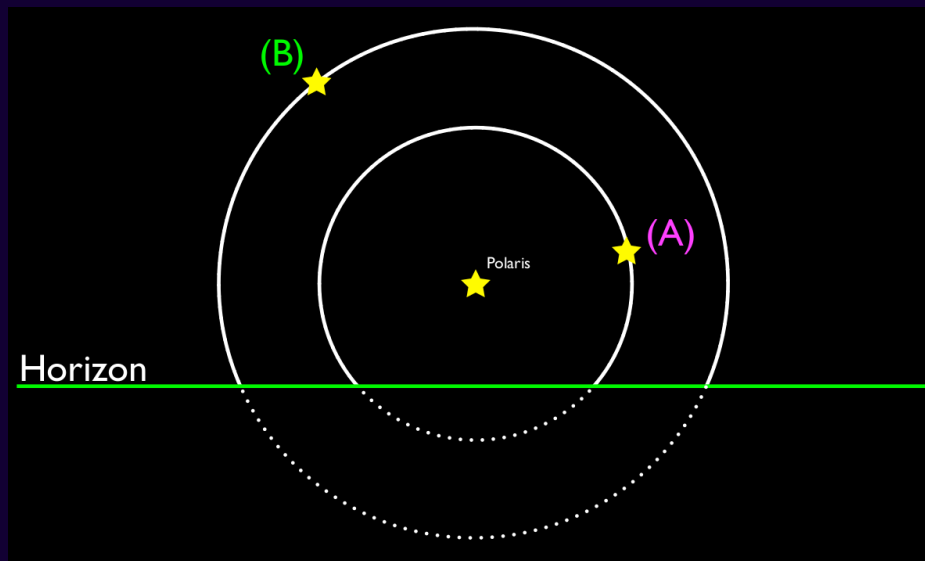
B: Low in the eastern sky

C: High in the northern sky

D: Low-ish in the northern sky

E: Low in the northern sky

What about now? Which star is visible longer?



What about the Sun?

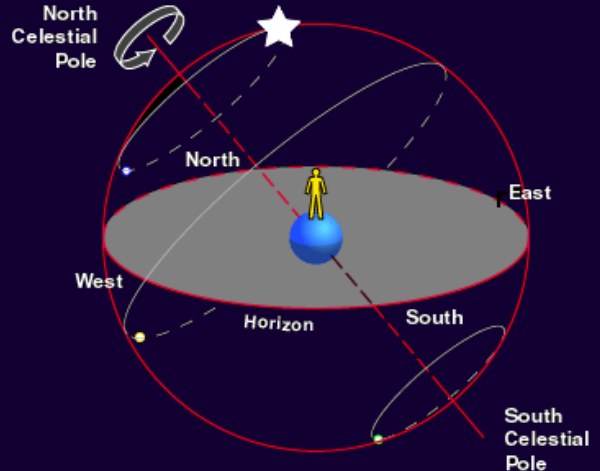
Over the course of one day, the Sun doesn't move very much in space relative to the Earth.

This means the celestial sphere model can show us how the Sun moves **each day**.

It rises in the East and sets in the West, just like all the other stars.

How long is this star visible in the sky each day?

- A: All the time
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A question for Thursday

How should we define a *day*?

- A: $1/365$ of a year
- B: The amount of time from midnight to midnight, or noon to noon
- C: The amount of time it takes for the celestial sphere to rotate once
- D: The amount of time it takes for Earth to rotate once

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- D: The amount of time it takes for Earth to rotate once
- E: Whatever we decide it is