

# The yearly motion of the sky

Astronomy 101  
Syracuse University, Fall 2016  
Walter Freeman

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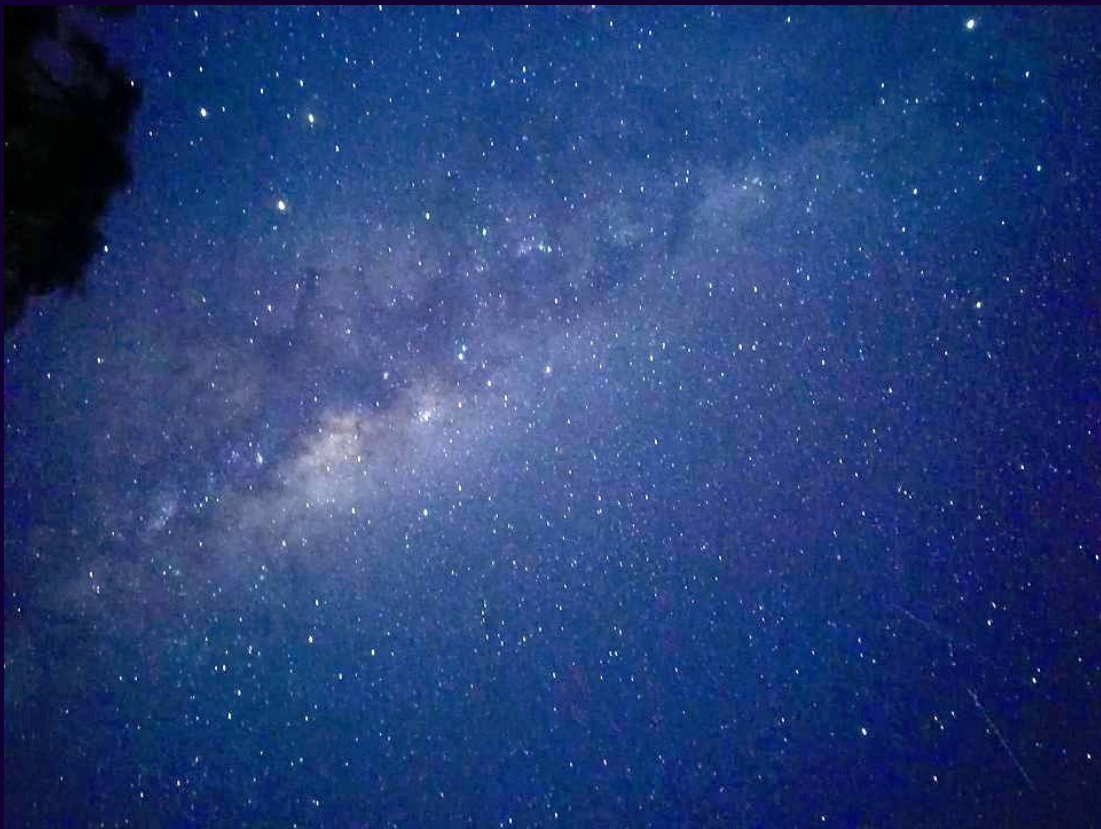
# The Sun and the stars: the zodiac

This is the excellent foppery of the world, that, when we are sick in fortune, often the surfeit of our own behaviour, we make guilty of our disasters the sun, the moon, and the stars; as if we were villains on necessity; fools by heavenly compulsion... An admirable evasion of whore-master man, to lay his goatish disposition to the charge of a star!

—William Shakespeare, *King Lear*

Astrology is a disease, not a science.

—Maimonides





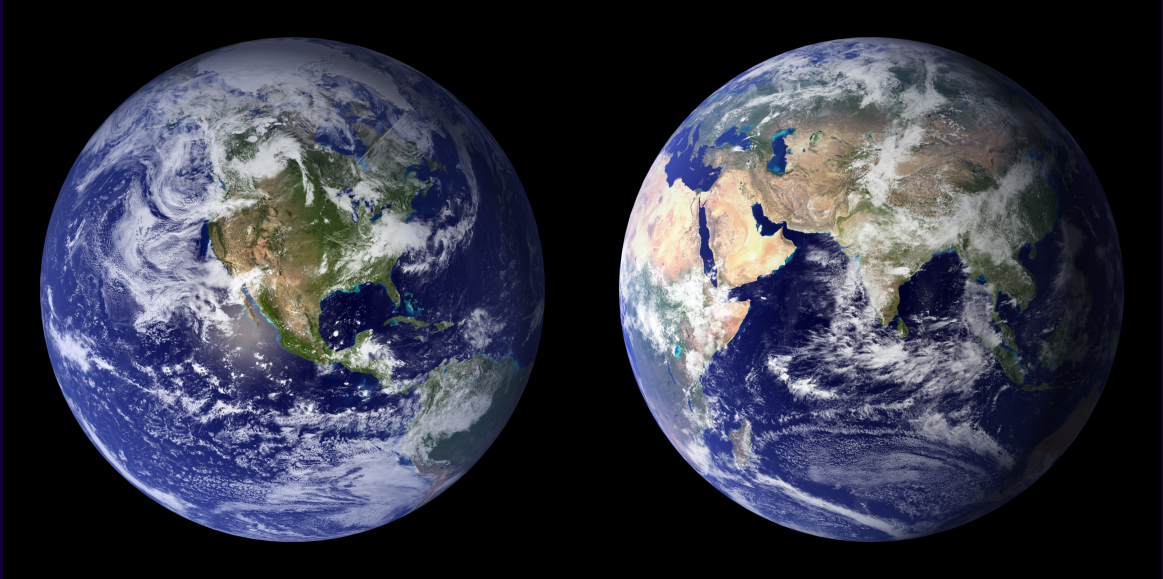
A friend of one of your classmates took these recently in Australia.

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... you can capture light from thousands of light-years away with an imager a centimeter across!



What kind of world is this? What *can't* you see?



Cast of *Star Trek*, 1968



# Some announcements

- Homework 1 postponed until next Thursday (you'll need some of Tuesday's material for it)
- Labs start next week

I called the bookstore Tuesday.

- They got an order in that morning
- All of the books went to people who preordered
- More should be in today
- Make an online preorder reservation to get yours first

Lots of people came by Tuesday asking some very good questions.

This is the absolute very best thing you can do to study for my class.

Come by the Clinic, Physics Building 112, and ask questions!

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

- How is the Sun different from the other stars?
- What's this zodiac business?
- What does it mean for the Sun to be “in Aries”?

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

- How is the Sun different from the other stars?
- What's this zodiac business?
- What does it mean for the Sun to be “in Aries”?
- We will see how this is only complicated because of **how we keep time**

# Which is true about the Sun?

A: The celestial sphere model predicts its motion exactly

B: The celestial sphere model predicts its daily motion, but isn't accurate for longer times

C: The celestial sphere model is completely wrong for the Sun

Why is the celestial sphere model a bit wrong for the Sun?

A: The Sun is close enough that the Earth's movement matters, unlike for other stars

B: The Sun lies on a different celestial sphere than the stars, which turns at a different rate

C: Angels push the Sun around on the celestial sphere, so it moves

D: The Sun is close enough that we notice its movement, unlike the other stars

# A demonstration

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... What's wrong?

... isn't the celestial sphere supposed to rotate once per day?

... Why are the stars moving?

... What's wrong?

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Now let's look at the sky during the *daytime*, pretending the atmosphere is gone.

Which moves more, the sun or the stars?

- The Sun just moves up and down a little bit, and the stars spin!
- ... why is this?

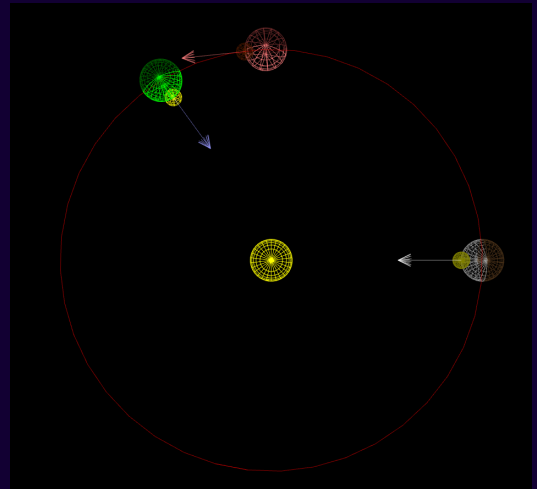
Let's animate this and try to understand.

Work through the *Lecture Tutorials*, pp.  
7-9.

We will talk about something else after this.

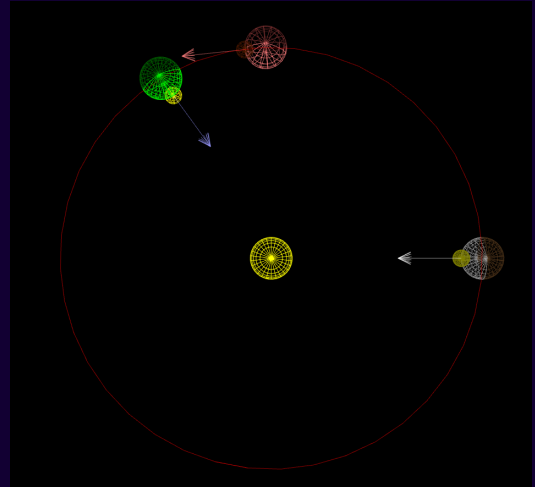
Which image shows the position of the Earth **exactly** one day later?

- A: Noon
- B: Midnight
- C: Sunrise
- D: Sunset





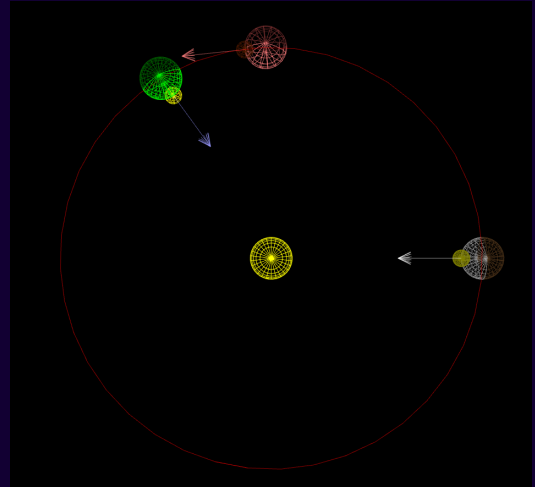
Which image shows the position of the Earth **exactly** one day later?



A: The red one

B: The green one

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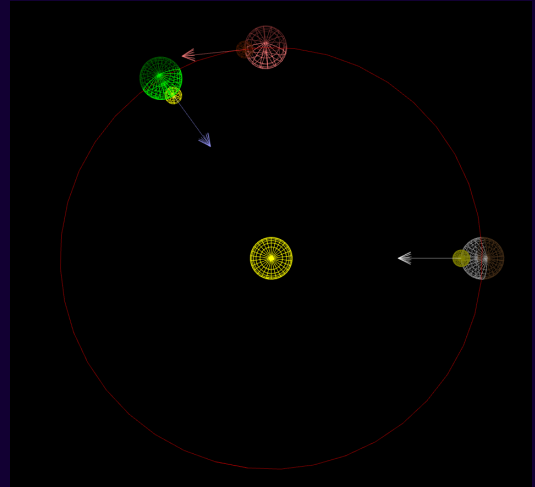


A: The red one

B: The green one

C: Depends on what you mean by “a day”

Which image shows the position of the Earth **exactly** one day later?



A: The red one

B: The green one

C: Depends on what you mean by “a day”

D: The Earth moves? BURN THE HERETIC!

There are *two kinds* of day!

- Solar day: judged by the position of the Sun
- Sidereal day (sih-dee-ree-al): judged only by the rotation of the Earth with respect to the stars

Work through the *Lecture Tutorials*, pp.  
11-12.

We will talk about something else after this.

# Two kinds of day!

## Demo in *Stellarium*:

### In one solar day...

- The stars move a lot
- ...since the Earth isn't pointed in the same direction
- The Sun moves higher or lower in the sky a little bit
- Exactly 24h

### In one sidereal day...

- The stars don't move at all
- ... since the Earth is pointed in the same direction
- The Sun moves a lot, since the Earth has moved
- A little bit less than 24h

Complete pp. 12-16.

If you don't have time to finish, that's okay. Finishing this is great practice at home, though!

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Live long and prosper!